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The Farmer's Digest

Volume 4 August, 1940 Number 4

Feeding Milk to Calves

Condensed from The Jersey Bulletin

George H. Wise
Clemson College, S. C.

AMONG dairymen there is much disagreement relative to the merits of various systems of raising calves, but there is one point on which all usually concur. That is, calves raised by the nurse cow method, "nature's way," generally manifest greater vigor, more bloom and fewer serious digestive disturbances than do calves raised by the common open pail hand feeding procedures. The thriftiness of calves that remain with nurse cows may be ascribed to one or more of the following factors: the freedom of milk from exterior contamination; the frequent consumption of relatively small amounts of milk; ingestion of milk at a constant temperature; the intake of certain gases and vitamins that are normally present in the milk in the udder but are either lost or decreased by exposure after milking; the slight germicidal action of milk when it is in the udder and for a short time after it is withdrawn; slow consumption of milk permitting much saliva to be mixed with it, and the passage of the milk directly to the abomasum (true stomach, fourth compartment) instead of spilling into the rumen (paunch, first compartment.)

Since the abomasum is the only section of the calf stomach in which milk is subjected to normal digestive processes, it is important that the milk pass directly into this compartment during consumption. If the milk en route to the abomasum happens to deviate from the normal passage, it spills into the rumen through the esophageal groove, a longtitudinal valve-like opening in the passage way from the esophagus (gullet)to the abomasum. This first compartment, designed by nature to aid in the utilization of coarse feeds, is not well developed anatomically and physiologically in the young calf that has not begun to consume hay and grain in appreciable

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amounts. Thus milk that happens to get into the rumen may remain trapped there undergoing abnormal fermentation. The decomposition products, which are not utilized, frequently produce digestive disturbances that eventually cause a general unthrifty appearance of the calf. Obviously it is desirable to use some method of feeding that will insure the direct passage of milk to the true stomach.

A nursing system, either a cow or a nipple feeder pail, seems to embody the principles necessary to effect the conveyance of the milk directly to the abomasum. These essential processes are consumption of milk in small swallows and prompt closure of the esophageal groove when drinking is initiated.

The esophageal groove is the only gateway to the rumen. In the closure of the groove its two edges are drawn together, shutting off the rumen and forming a tube through which milk passes en route to the abomasum. If, in the act of swallowing, the milk arrive at the groove before it closes, as frequently happens when the calf drinks from an open pail, much of the fluid spills into the rumen. Though the groove may be contracted normally when drinking is initiated, the volume of the swallows of a hungry calf gulping milk may be sufficient to force the edges of the groove apart permitting spurts to enter the rumen. When the calf sucks, the act not only stimulates prompt closure of the groove but also permits only a small quantity of milk to be swallowed at one time.

The Dairy Department of the South Carolina Agricultural Experiment Station recently studied the course followed by milk as it was consumed either from an open pail or through a rubber nipple. The experimental subjects were seven young calves having rumen fistulate, openings commonly referred to as "windows in the paunches." By means of a small light inserted into these openings it was possible to observe the esophageal groove of each calf as the milk was swallowed. Thus it was relatively easy to determine whether or not the milk passed through the groove into the rumen.

The investigation revealed that in 945 feedings from open pails, milk entered the rumen in 349 cases, or 37 per cent. The frequency of entrance for individual calves ranged from 0 per cent for the lowest to 78 per cent for the highest, and the quantity oftentimes amounted to several pounds. From 457 feedings by nipple pail the milk entered the rumen in only 2.2 per cent of the cases, in which the quantity never exceeded one teaspoonful. On the basis of these observations the

nipple feeder pail as a hand feeding method, offers a fundamental and practical solution to several of the open pail feeding problems but cannot be considered as a panacea for all digestive disturbances of the calf.

When milk enters the rumen it does not cause digestive disturbances in every case; yet it is always a potential danger. This peril apparently lessens as the calf becomes older, providing that adequate concentrates and roughages are fed. As the calf grows, it normally consumes increasing amounts of coarse feeds, stimulating enlargement and increased activity of the rumen. Milk entering this first compartment is mixed with food substances present. The activity of this section of the stomach empties the milk, with other materials, into channels leading to the true stomach. This outflow resulting from the movement of the rumen prevents the milk from accumulating and fermenting.

Though the obvious value of the nursing system becomes less as the calf grows older, the advantages for calves over two months of age are, by no means, nil. Even though the action of the rumen of the older calf prevents the accumulation of milk that may enter, it does not avert dilution of the milk by other fluids normally present in this section. It has been suggested that this dilution interferes with coagulation and subsequent digestion of milk in the true stomach. Partial digestion obviously would mean inefficient utilization of the milk, which failure would hardly be detectable in a calf receiving a surplus of nutrients from other sources but would be manifested in calves sparsely fed.

The advantages, from a physiological and a nutritional viewpoint, of the nipple feeder pail are sufficient in many cases to warrant the use of this method throughout the milk feeding period. However, after calves begin consuming hay in appreciable quantities, the dangers of digestive upsets from open pail feeding become insignificant.

Beef-Making Equipment

Condensed from Capper's Farmer

N. B. Morse

REDUCING labor charges for beef making is one way of boosting income from feed. Armour Morgan, Vermillion county, Indiana, maintains one unit which illustrates the point. Equipment provided enables one man to feed and bed 200 steers in 3½ hours a day, the same time formerly required in caring for 50 head. Thus the labor charge against beef turned out at that plant has been reduced 75 per cent.

The site was selected for its proximity to pasture, on which cattle are fed in summer, rather than convenience to the farmstead. Further, winter feeding operations at the headquarters plant were of such extent that another was desirable to relieve congestion and diversify risk. But the distance from main feed storage was so great as to require time consuming chores in haulage to supply the unit from his farmstead, so it was made complete.

It consists of a 60- by 90-foot barn with hay and straw storage overhead and bed space below. On the south, adjoining the open front loafing section is a 40- by 110-foot concrete pavement. Around the outside segments of this is a steel post supported track to supply bunks which are set in from the edge far enough that cattle can feed from both sides of them. Hay is fed inside from ceiling supported, adjustable swinging racks.

These racks have rectangular frames of 1¼-inch pipe, 30 inches wide, 30 inches deep and as long as desired. They are equipped with a rounded metal manger for catching leaves and fine particles of hay that otherwise would drop to the ground and be trampled. Inside the frame is the customary V-shaped hopper with vertical slats 4 feet long which insures that the hay will feed down automatically. The racks may be lifted as manure and bedding accumulate in the shed. The swinging principle he believes avoids injury to the cattle.

A self-feeder is provided on the north for cattle on summer pasture. A grain bin will accommodate a week's supply. At the northeast corner of the barn is a 14- by 60-foot silo. The plant will take care of 250 calves or 175 yearlings and is in constant use, winter and summer.

Mr. Morgan receives western

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weanlings usually during October. They are started on about 3 pounds oats, 4 of corn and 1 of supplement with silage and all the hay they will take. By April 1 he has them consuming about 15 pounds of grain mix daily. About that time they go to grass and receive their grain, in self-feeders. Ground ear corn is fed until grass begins to cure, about June 15, when half of it is replaced by shelled corn. The combination is fed until August 15. Then a change is made to straight shelled corn on which they are finished for market any time from September to November.

At the farmstead Mr. Morgan maintains another feeding plant for winter operations. The lot is on a slope paved with concrete and enclosed by a concrete wall which saves all manure. The enclosure is water-tight so that not even liquid manure escapes. Bunks are set on the two areas of concrete, 40 by 200 and 33 by 80 feet. Self-feeders also are available under shelter.

In feed production and preparation, Mr. Morgan uses equipment to the fullest extent. He employs four tractors, three of which are general-purpose, in field and processing work. To reduce labor in filling a silo with alfalfa, he assembled machinery which would handle the green hay. An ensilage cutter, powered by a combine motor, was mounted on a 2-wheel trailer which was pulled behind one of the general-purpose tractors. A hay loader trailed the outfit in such manner as to discharge into the cutter. The chopped material was blown into trucks for hauling to the silo. Sixty pounds of molasses a ton were introduced at the blower. In feeding this alfalfa silage to heavy steers he discovered it served as an appetizer and they increased their grain consumption 25 per cent with a consequent shortening of the fattening period. It was mixed with corn and cob meal and supplement.

Silage making has been completely mechanized. "We used to do lots of work on silage," he said. "Originally corn was cut by hand and hauled to a stationary cutter in the conventional manner. Then we got a corn binder which reduced hand labor considerably but there was still heavy work in loading and feeding the bundles through the cutter. Then we eliminated the field lift by providing two binders with loader attachments. Finally they were replaced by a field cutter. Our last improvement in the process was to add two dump trucks with hydraulic lifts."

Mr. Morgan likes to feed chopped hay, and for two years processed the alfalfa as it was put into the barn, but abandoned that practice because he developed one which reduces labor at haying

time and eliminates the danger of spontaneous combustion.

I discovered that baling in the field was the quickest way of saving hay," he continued, "and that a pickup press was the greatest labor saver. At first I rigged up a machine of my own but later bought a standard field baler. It makes the best quality hay I ever had because it saves all the leaves. A loader which pushes the hay onto a trailing, flat bottom wagon eliminates picking the pressed hay up in the field. A crew with tractor takes the loaded wagons to the barn where I have a specially designed fork which will lift six bales at a time and carry them into the mow.

"I'm using the pickup strictly as a means of making hay. The savings and quality justify it. But I still like chopped roughage. It, too, has advantages which justify the expense and so I process the bales. Chopped hay is especially desirable for getting steers on feed. It enables me to regulate the ration better—make the cattle eat what they ought to have. Another advantage is that I can mix the hay with new grain and so begin using it sooner than might be safe otherwise."

At the farmstead, equipment is arranged on the principle of an assembly line so that feed preparation and mixing is a continuous process from bins, cribs, mows and silo to the cattle.

The hay chopper is mounted permanently across a runway on to which trucks may be backed so that feed may be unloaded directly into it. The blower discharges into bins in a mill building which is equipped with grinding and mixing machinery. If corn is to be chopped it is blown into one side of the mill and hay into the other. Grain is run into four small bins from which it may be spouted into trucks or wagons.

At feeding time, corn and cob meal and chopped hay are loaded at the elevator, and silage at the silo. The hand-fed ration is thus made up as feed wagons proceed toward the bunks.

Mr. Morgan finishes 800 to 1,000 cattle annually and so labor charges without special equipment would contribute greatly to beef-making costs. That number of cattle also produce sizeable quantities of manure. To handle this efficiently he also employs equipment. A loader which mounts on the front of a tractor keeps two spreaders going, with a third to be loaded while the others have gone to the field. Two tractors are used in hauling. Four scoops of the loader will fill a spreader. With this equipment sixty loads of manure can be distributed in a day.

Ladino Clover "Sells" Itself

Condensed from Better Crops with Plant Food

Ralph W. Donaldson

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LADINO clover is gaining acreage as a pasture crop in Massachusetts. So far new seedings have doubled each successive year. With 600 acres seeded in 1937, 1,500 were added in 1938, and 2,500 acres more have been seeded in 1939. From the total of these recent seedings there should be more than 4,000 acres of Ladino stands in 1940. Yet ten years ago this clover was unknown to farmers of this northeast region.

It was the spring of 1929 to be exact, when John Ellis, owner of a leading Holstein herd first introduced Ladino seed from Idaho to Massachusetts. That season he seeded a small patch for observation on his farm located in the Berkshire hills. The clover thrived and made a dense growth reaching almost to his knees. A ten-acre grazing trial made him still more enthusiastic. Several neighbors, watching its performance, were intrigued, which led in turn to others growing it. Thus the acreage has been expanding. One factor responsible for its gain in popularity unquestionably is this —Ladino "sells" itself.

Ladino clover (Trifolium repens var. Latum) resembles white Dutch except for its "giant" size. The plant once established spreads by means of surface runners which grow and root along the ground and produce the main crop of leaves and blossoms. Some notion of its spreading habit may be gained by describing its behavior in seeded rows. These single plants, spaced four feet apart, produced a complete ground coverage by the end of 12 months from date of seeding.

In height of stalk and size of leaves, however, a stand of Ladino appears like one of red or alsike clover. The tall growth of this clover (6 to 20 inches) enables this plant to compete successfully with the common tall hay plants which suppress the growth of smaller pasture clovers. It is this characteristic mainly, as well as the capacity for high yields under grazing management, which attracts farmers to substitute Ladino for white Dutch in mixtures sown for grazing use.

Ladino excels as a grazing crop for dairy cows. The dense, tall

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growth enables a cow to fill up quickly and to produce milk efficiently with little grain. Ladino grazing compares favorably with a half-grown stand of red clover or alfalfa in this respect and is readily consumed. After perhaps an hour's grazing the cow is full with ample time to lie down and chew her cud.

According to this authority, it makes a difference what *kind* of pasturage is fed in determining the need for extra grain. For the production of 30 pounds of four per cent milk, for instance, he states the daily requirements for a cow may be as follows: on *fair* pasture, 10.2 pounds of grain; on *good* pasture 6.3 pounds of grain; and on *excellent* grazing only 2.4 pounds of grain. If a saving of grain feed is desired from pasture use, then the "excellent" form of it merits the emphasis.

Ladino seems to yield more grazing to the acre than is common from other crops. One of the apparent reasons for its yield of pasture feed is the ability of its plants to recover rapidly after the growth is cropped.

During favorable periods for its growth, a two-week interval normally is sufficient for recovery of adequate growth for regrazing. It is only during seasonal periods of deficient moisture that longer intervals may be needed for recovery.

During the spring period of greatest growth, a good stand of Ladino will usually require 8 to 10 cows to the acre for about a week to crop it down. While several inches of growth still remain, the animals should be moved to a second area. To have at least three such smaller areas, each of the size to accommodate the herd on the basis of about 10 cows to the acre, gives opportunity for rotation and rest intervals which are important for best results. Any surplus lots of feed during the early part of the season may be cut for hay or be ensiled for August feeding.

While the spring flush of growth may afford a carrying capacity as high as three cows to the acre for several weeks or more, yet reduced growth in later months may lower the carrying capacity to less than one cow to the acre, depending largely on the moisture. To secure good grazing during a 150-day period, 1½ cows to the acre has been the figure usually employed in estimations.

Ladino also appeals to farmers because it can be established simply. The same cultural and fertility practices required for seeding of red and alsike clovers are suitable for Ladino. The same seeding mixture employed for establishing a hay crop may be used. The only new effort involved is to see that one or two

pounds of Ladino seed are included in the mixture for an acre. Nor is it necessary even to inoculate the seed.

Moreover by seeding Ladino with a common mixture, the farmer incurs no added risk if this clover should fail to grow. There still remains the normal expectancy of crop from his customary seeding.

Some consideration should be given, however, to the matter of selection of areas for seeding to Ladino. It is well to avoid the drier soils and to select areas of better moisture. Adequate moisture is important to the growth of this shallow-rooting plant. Soils moist enough for alsike or the smaller pasture strains of clover generally are most suitable for the seeding of Ladino. The plants tend to be shorter lived on the drier soils than on the wetter soils.

Ladino extends the period of productive clover growth in mixed seedings an extra year or so by filling in the place of red and alsike clovers which are shorter lived. The productiveness, in fact, may be as great for grazing when Ladino takes their place, because of its ability to recover more rapidly when grazed. The sequence of growth is somewhat as follows:

The next spring after seeding, the stand is generally a mixture of red or alsike clover with some Ladino and is suitable either for hay, or grazing; later in the season Ladino usually predominates. The second and often the third years of sod (when timothy normally predominates) may be almost solid Ladino in which case the crop is handled more easily as grazing than for mowing. Usually by the fourth season grasses come in to form a mixed stand, and Ladino may go out and be replaced by grasses or natural pasture clover depending on fertility and other conditions. A field on the Sturtevant farm, Halifax, has survived eight years, and the Ladino is still productive. This stand each year has been first cut for hay and then pastured to furnish valuable mid-season grazing.

In order to produce its heavy yield, liberal feeding of the crop is important. If adequate manure, lime, and superphosphate have been added in fitting the soil to establish well the initial clover seeding, then annual feeding of the subsequent Ladino stand may be accomplished by top-dressing. This is possible largely because of the surface feeding habit of its runners.

A treatment found desirable for Ladino in this State is a mixture of about 250 pounds each of muriate of potash and of 20 per cent superphosphate (or its equivalent) to the acre. This is applied annually as top-dressing.

This treatment has been followed on the Sturtevant field in addition to a light dressing of manure.

Field tests of varying amounts of phosphorus and potash applied as top-dressing for Ladino indicate a response especially to high amounts of potash on Massachusetts soils. In these tests the response in most cases was decidedly greater from potash than from superphosphate, but the response was slightly best from applying both these items. A 300-pound rate of muriate of potash (60 per cent) seemed optimum for annual application, whereas a 150-pound rate failed to show as marked response. The addition of superphosphate (20 per cent) at 200- to 300-pound rates was beneficial if applied along with potash.

Ladino has not proved of value as a clover for permanent pasture sods. In this respect undoubtedly the smaller strains seem superior largely because of their ability to survive under close grazing practice. The chief value gained from Ladino comes in the early stages of a seeding, and for this reason the seed is included in mixtures seeded primarily for grazing use. As a grazing crop for intensive management and feeding of dairy cows to to save on grain, it seems to have no equal in this region.

How the Army Handles Meat

Condensed from The Cattleman

Arnold Kruckman

MORE than 75,000,000 lbs. of meat are purchased annually for the regular standing army of the United States, each enlisted man being allowed 18 oz. of meat per day. Meat is not only the largest single item in the military menu, but is considered one of the most important in the army's entire food plan. More money is paid for meat than for any other food staple.

To handle this important food efficiently, the army maintains 12 major schools where it teaches 1,000 young men every year to become skilled meat men. The schools are operated by the Quartermaster's Corps and are located at Camp Devons, Mass.; Fort Totten, N. Y.; Fort Mead, Md.; Fort Benning, Ga.; Fort Sheridan, Ill.; Fort Riley, Kans. Fort Sam Houston, Texas; the Presidio, San Francisco; Fort Harrison, Ind., and in the Canal Zone, Hawaii, and the Philippines.

Each student receives at least four months' training. There is an average of 50 men in each class. They are taught to cook and to bake as well as to handle meat. At the end of the four-month course of training those who have special aptitudes as cooks or bakers are detailed to such duties, and those who make the best meat men are spread around among the 300 army posts to serve at the commissaries.

While not every "butcher" must cook and bake, it is interesting to find that every cook and baker must learn the fundamentals of meat handling in the army. Choice of meat is not more important than its preparation. It is for this reason that the army obliges its cooks to study meat and the methods by which meat is made ready for the cook. Officers of the army emphasize that there is a sharp difference between the style of army cooking and cooking for civilians. They declare the advantage is with the army. Army meat preparation and cooking are mass production. Meat is prepared for units of 250 men. Roasts that weigh 18 pounds are common place in the army mess.

Instruction courses at the schools are entirely practical. The students alternate theoretical

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instruction and demonstration with actual mess experience. On every other day they take over the duties of preparing the meat, and of cooking the food and baking the bread and pastries for the unit to which they are attached.

The teaching staff is composed solely of non-commissioned officers. They are competent men who usually have been in the army for a long time. The curricula, based on commercial practice, are founded on meat handling as it has been developed in commercial wholesale and retail businesses. The whole technique of meat cutting follows modern and economical lines. Nutrition, merits of various parts of a carcass, their relative food and money value, are discussed and illustrated.

After the men have finished a four-month course, they are detailed to line regiments. The food problems of a regiment are entrusted to a unit called a "mess." Each mess has a mess sergeant and three aides who appear on the payrolls as cooks. However, one of the cooks is a baker, and another a meat specialist. The mess sergeant is a highly competent meat specialist himself and acts as purchasing agent, known in the army as procurement officer. He makes all purchases on a competitive basis.

Sergeants rate as technicians and usually receive $154 cash per month, plus lodging, board, clothes, and medical care, which are estimated to have an additional value of $70. The meat specialist, who has no rank as a rule, receives the base pay of a first class private, which is $30 cash per month, plus his specialist's bonus, ranging from $10 to $20 additional. Thus, with his board, lodging, clothes and medical attention, the army estimates he receives from $110 to $120 per month.

The butcher-specialist soldier, as he is known in the army, also is detailed to the post commissary. There are more than 300 posts in the United States and its possessions. The commissaries are operated for the service of the officers and the married noncommissioned officers. Each commissary has a very well stocked and equipped meat market. The trade is always brisk.

Butcher-soldiers invariably work between 8 and 10 hours each day. They work with the usual facilities of a meat market. Every post meat shop has a refrigeration unit, either electrical, ice, or brine. The tools are the usual blocks, saws, knives, grinders and similar apparatus. Often there are several butchers at one post. The army has 4,700 men capable of conducting a post meat market. The work is regarded as perfect practical experience for retail meat merchandising.

Men who develop the aptitude are eligible to attend the Quartermaster Corps school at Chicago. This is regarded as the advanced training center for meat and other food men. The students usually are the picked noncommissioned officers of the army with qualifications to become trained meat inspectors. The army depends upon their judgment in appraising meat plants. They receive their instruction under Dr. Jesse H. White, who conducts the special course on the quality of edible meat products. Dr. White is considered by the army as one of the foremost authorities in the world. A specialist for forty years, he has taught the course at the Chicago school since 1921.

Should war come at any time, the army mobilization plan provides for the organization of special butcher companies. It is planned that each company shall be composed of 45 men, ten such companies being provided for. With each company there will be a corresponding complement of auto drivers to transport the meat and the administrative personnel. Each butcher unit is scheduled to supply meat to 100,000 soldiers. This is not an emergency feature, but a part of the regular plan.

The members of each company are to be chosen from the most experienced trained specialists in the army, and from among civilian volunteers. Each unit would be equipped with mobile refrigeration equipment. Meat would be received in carload lots. The task of the butcher companies would be to cut the meat for use by each mess, to pack it in the mobile refrigerators, and distribute it to points where needed for consumption by the troops. In case of war, it would be expected that these butcher companies, highly specialized and highly necessary, would move right up behind the frontline trenches. Meat and other foods, but chiefly meat, are considered keystones in maintaining the army morale under war conditions.

Roughage as Exclusive Ration for Dairy Cows

Condensed from Guernsey Breeders' Journal

S. R. Winters

THE practicability of feeding dairy cattle on roughage alone should be of interest to every dairy farmer. The present economic situation puts considerable emphasis on the necessity of keeping costs of milk production at a low level. Also, there has been a growing realization of late that extremely high milk production per cow, when obtained by heavy grain feeding, is not necessarily the most economical yield.

During the last few years the Bureau of Dairy Industry, Department of Agriculture, has concerned itself with various phases of this problem. A summary of the work done in four of the field experiment stations—at Mandan, North Dakota; Huntley, Montana; Woodward, Oklahoma, and Ardmore, South Dakota—has been made. It is concerned primarily with the feeding of field-cured alfalfa hay as the exclusive ration.

Alfalfa hay was selected because its production has increased markedly in many sections of the country within the last few years. It is a cheaper source of nutrients for milk production than most other crops which can be produced where it grows best. It is also a soil improver and plays an important part in the conservation of land and in the control of erosion.

In normal dairy practice alfalfa hay would not be fed exclusively throughout the year, but would be used in conjunction with available pasture. For the purposes of experimentation, it was desirable to make it the sole ration because the amount of nutrients consumed by the cows can be measured more accurately and, without the complicating factors of relative values of pastures, the results are more clear cut.

In this experiment fifteen registered cows were used. Each had completed at least one 365-day production record under full-feed conditions. The full feed consisted of one pound of grain for every three pounds of milk produced, plus alfalfa hay, silage and pasture. All these cows, under favorable feeding conditions, were capable of a high level of production.

Each cow was put on alfalfa hay ration about thirty days before calving so that she would be well established on it when lactation began. Once on this ration, the cow was fed alfalfa hay ex-

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clusively through the lactation, and dry periods. Of the fifteen cows seven were on the experiment for two consecutive lactations, and two for three consecutive lactations.

The alfalfa hay used in this experiment varied somewhat in quality. Some of it was locally grown, some purchased; all was field cured. Although poor quality hay was occasionally fed for short periods of time, the bulk of the hay used would have graded U. S. Number 1 alfalfa. All cows had access to salt and to a box of special steamed bone meal. Little, if any, of the latter was eaten.

When the records for these cows on full feed were compared with their records on alfalfa hay, it was found that on the latter they averaged, for the twenty-four lactation periods included, 11,125 pounds of milk and 389.6 pounds of butter fat, mature basis. This was fifty-seven per cent as much milk and sixty per cent as much butter fat as they gave on full feed. There is reason to believe, however, that cows which were accustomed to a diet of high quality roughage for somewhat longer periods might make higher percentages.

The milk yield declined more rapidly when the cows were fed alfalfa hay than when they were on full feed. They gave only 61.8 per cent of the maximum daily yield in the sixth month on alfalfa. At the same point on the full-feed rations, they gave 85.6 per cent. Part of the difference may be accounted for by the fact that most of the figures for the full-feed lactation periods came from first lactations when cows generally are more persistent.

There is apparently little difference in the efficiency for milk production of the total digestible nutrients derived from the alfalfa hay and those derived from the grain, hay and silage ration. A comparison of nine records under both systems for the first 280 days of lactation shows that on the alfalfa hay the cows averaged 3.16 pounds (3.57 per cent fat) of milk for each pound of total digestible nutrients available for production as compared with an average of 2.71 pounds (3.49 per cent fat) of milk for each pound of total digestible nutrients consumed above maintenance requirements on full feed.

The effects of the alfalfa hay diet on the health of the cows was closely observed. There was a slight decline in body weight during the first lactation on alfalfa hay, but no significant decline during the second, nor (in so far as it is possible to judge with the limited figures available) during the third. Even though the cows fed on alfalfa were lighter in weight than when on full feed, they were never extremely thin

or emaciated. Early in lactation they became thin but gained during the dry period so that they looked like well-fed cows.

The continued feeding of alfalfa hay as the sole ration had no apparent effect on the fertility of the cows. The ratios of services to conceptions show little, if any, difference between the cows when on full feed or on alfalfa. That this diet had no ill effects on calving is shown by the fact that eighty-seven per cent of the calves conceived and born when the cows were on alfalfa were normal and living at birth. On the other systems of feeding, ninety per cent of the calves were normal and living at birth.

The economy of feeding alfalfa hay as the exclusive ration is of great importance. An analysis by the Bureau of Dairy Industry shows that alfalfa hay produced a greater quantity of total digestible nutrients per acre than any other crop, or eighteen per cent more than corn, which ranked second. It costs less to produce 100 pounds of digestible nutrients in alfalfa and timothy hay than in any other crop. Clover is a close second in cost. But compared with the cost of alfalfa and timothy hays, husked corn costs thirty-four per cent more, corn silage 154 per cent more, oats, 155 per cent, wheat, 189 per cent, and barley, 111 per cent.

When costs for various types of fullgrain and limited grain rations are computed from these figures and compared with alfalfa hay, it is evident that considerable economy can be effected in dairy practice by more extensive use of roughage. It has been suggested by the Bureau of Dairy Industry that most dairy farmers would do well to change their system of farming to one in which they would keep most of their land in permanent pasture and in legumes and grow very little grain. Pasture and other roughage would be the basal ration and grain would be fed only when the resulting increase in milk or butter fat production could be obtained at a profit. Of course, the farmer gets less milk from cows on roughage rations, but the cost of such feeds would be enough lower to make production more profitable.

Under some conditions the substitution of hays and silages made from immature pasture grasses may effect even greater economies without damaging results to the health and productivity of the cattle. Results of an experiment conducted in the field experiment station of the Bureau of Dairy Industry at Huntley, Montana, are of interest in this connection.

Here, because the experiment aimed to test the relative advantages of the hay and the silage as well as the practicability of feed-

ing cows only on roughage, the cows were divided into two groups. They had been tested under full-feed conditions to determine their inherent capacity for milk and butter fat production. The full feed ration was much the same as that used with the cows in the experiment above. It consisted of liberal amounts of grain, alfalfa hay, corn silage and pasture. The grain mixture was fed at the rate of one pound of grain to each three pounds of milk produced. In a few cases, beet pulp was fed for short periods.

The grass hay and grass silage used in this experiment were made from grass produced at the Huntley Station on an eighteen-acre plot. The plot had been seeded (about four years before the experiment began) with the following grass mixture, at the rate of twenty pounds per acre: Awnless bromegrass, two pounds; orchard grass, five pounds; meadow fescue, three pounds; perennial ryegrass, three pounds; Kentucky bluegrass, four pounds; white clover, two pounds, and alsike clover, two pounds. By the time the experiment began, considerable volunteer alfalfa had appeared in the plot. No fertilizer had been used and the yield was somewhat low. The field was under irrigation and ample water was available.

The grass was cut four times each season at immature stages of growth and part of each cutting was made into hay, part into silage. Samples of hay and silage from each cutting were analyzed. The average contents of the hay, which was field cured, was much the same as that of the alfalfa used in the above experiment as regards crude protein and crude fiber content. The average fat content and nitrogen-free extract, however, were higher than is usually found in alfalfa hay. In average composition the silage was slightly superior to the grass hay. Its protein content greatly exceeded that of most corn silage.

When the records of the group of cows fed exclusively on the grass hay ration were compared with their records on full feed, it was found that they gave 64.4 per cent as much milk and 63.4 per cent as much butter fat on grass hay. The group fed on grass silage gave 61.2 per cent as much milk and 61.5 per cent as much butter fat as they gave on full feed.

During the course of the experiment shortages of the grass hay and silage occurred. Alfalfa hay was substituted and the milk yield declined. It increased again when the grass hay and grass silage were resumed. This supports the belief that the dry matter in the immature grass hay and silage is superior for milk production to the dry matter in alfalfa hay, which is cut in maturity

when half or more of the plants are in bloom.

During the experiment, the cows were offered more hay and silage than they would readily consume. Records of exact amounts eaten were kept and when they were totaled, it was found that the cows on grass hay had consumed nineteen per cent more digestible nutrients than were required for their maintenance and production. On full feed these same cows had consumed an excess of seven per cent. The cows on the grass silage rations were found to have consumed only three per cent more digestible nutrients than they required. On full feed these cows had exceeded their requirement by nine per cent.

Through an entire lactation period the average amount of dry matter consumed per pound of milk produced and pound of dry matter in the milk produced was somewhat greater for the grass hay group than for the grass silage group. This does not necessarily mean that the dry matter in the silage was more efficient for milk production. Both groups consumed more than enough dry matter to meet their requirements, but the cows on grass hay had a greater excess consumption.

All cows in the experiment appeared to be in normal health. The grass hay group had perfect breeding records except one cow, which required two services for conception and aborted after 242 days. In the grass silage group, there was breeding trouble but since most of the cows had poor breeding records anyway, it is doubtful whether the difficulty can be attributed to the grass silage ration.

The results of this experiment seem to indicate that, when it is cut in immature stages of growth, succulent pasture grass can be made into silage or hay of high enough quality to provide the sole ration for dairy cattle. In normal dairy practice, as we suggested in the experiment with alfalfa hay, pasture would be used whenever available.

The higher milk yields to be obtained by the use of pasture are illustrated by an experiment begun in 1932 at the Lewisburg, Tennessee, field experiment station of the Bureau of Dairy Industry. Twenty-six cows have completed thirty lactation period records in which their milk yield averaged sixty-eight per cent as much milk and sixty-six percent as much butter fat as the milk they gave on full feed. However, machine dried hay, made up of forty per cent alfalfa, twenty-four per cent soybean and thirty-six per cent miscellaneous hays, was fed. And in the pasture used Kentucky bluegrass predominated.

The full feed on which records for comparison were made con-

sisted of the machine-dried hay and pasture and one pound of grain for each 2.77 pounds of milk produced.

Because of the content of the hay, the composition of the pasture and the fact that the hay was machine-dried, the results in this test are not so significant for the average dairy farmer as are those from experiments where the procedure approximates more nearly the ordinary farm conditions.

Capons

THE North Dakota Experiment Station determined in a 3-year feeding test with 2 different breeds of poultry that from standpoint of gain and feed cost, capons reach their most economical weights when 30 to 32 weeks old. After about 30 weeks, the experiment showed, capon gains decrease rapidly and feed-consumption increases to such an extent that gains cease to be profitable.

Early-hatched Jersey White Giants, caponized at 10 weeks, averaged 7.82 pounds per bird when 30 weeks old and used 42.83 pounds of feed up to that time. Late-hatched capons of the same breed averaged heavier—8.38 pounds each at the same age—but used more feed, a total of 49.17 pounds per bird. On that basis, with feed at $2.15 per hundred pounds, the early capons should sell at 11¾ cents per pound and the others at 12½ cents, live weight, to pay for the feed. For complete costs, the station pointed out, 4 cents a pound should be added to these figures to cover miscellaneous items. This means between 16 and 17 cents of the live-weight selling price per pound would be required to cover production costs. Lower or higher feed costs naturally would change this situation. Rhode Island Reds used at the station did not prove as satisfactory for capons as Jersey White Giants. Gains all through the feeding period were less and the weight at 30 weeks was approximately 6 pounds per bird, which is lighter than desired on most capon markets. The Rhode Island Red gains after 22 weeks were hardly profitable.—*W. J. H., Minn., Successful Farming*

Jumping Ahead of Hoppers with Poisons and Barriers

Condensed from The Western Farm Life

A. S. Cook

AN appropriation bill of $2,500,000 passed by congress will enable an army of workers to open an offensive against the hordes of Mormon crickets and grasshoppers which will soon invade the western states unless stern preventive measures are taken.

The Mormon cricket, so-called because it first made its appearance as a menace to crops of the Mormon pioneers in Utah in 1847, has since invaded all of the western states. This year infested states will include Washington. Oregon, Idaho, Montana, Nevada, Utah, Wyoming and parts of South Dakota and Colorado.

A few years ago the infestation was so bad in Nevada and Montana that adult crickets migrating across the paved highway endangered travel. Those crushed by passing cars made the road dangerously slippery.

Control measures which have done much toward reducing the cricket population include poisoning by arsenical dust and trapping. The poison recommended by the Colorado agricultural experiment station is one part sodium arsenite to four parts of hydrated lime. This poison dust is mixed at a central plant established near a railroad, and operations are supervised by a competent foreman. When a cloud of dust is directed on a mass of crickets, the lime and sodium arsenite set up an irritation, causing the cricket to attempt cleaning its antennae and foot parts by passing them through the mouth. In this way the arsenic is taken into the stomach, resulting in death.

Barriers are used effectively in controlling migrating hordes. A 15-inch sheet-iron fence, erected a considerable distance ahead of the crickets, will stop their progress and they can be trapped in pits. Once in the pit the crickets die, either from suffocation or because of their cannibalistic nature, one cricket feeding on another. In approximately 700 pits in Nevada a few years ago, 50,000 cubic feet of crickets were trapped and destroyed.

Preliminary hopper control work was done last fall by making egg surveys in square foot

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samples of earth taken at random in representative fields throughout the infested areas. The survey indicated a marked decrease in hoppers for 1940, due to the control measures last year which, according to Dr. Lee A. Strong, chief of the United States bureau of entomology and plant quarantine, were more effective than any preceding campaign. The egg survey also showed that there will be a shift from the areas formerly infested to abandoned lands in the plains states.

Many farmers and ranchers have the erroneous idea that castor beans planted throughout a crop are protection against hoppers. Experiments conducted by the bureau of entomology and plant quarantine disprove this theory. Even when confined in cages with growing castor beans and oat plants, the hoppers thrive on the oats and scarcely nibble on the castor beans.

Migratory hoppers are a greater menace to the farmers than local hoppers, but the depradations of both can be halted if action is taken in time. Hoppers have been known to gnaw the wooden handles of farm implements and the champing of myriad tiny jaws is not a pleasant sound to hear.

In recent years, sawdust has been substituted for much of the bran formerly used in the bait, and the addition of molasses, banana oil, citrous fruits or other strong-smelling substances are no longer considered necessary. A formula recommended is one part of bran to three parts sawdust, mixed with liquid sodium arsenite and water. The finer material forms a poisoned paste which coats the sawdust particles. The hoppers chew the sawdust to obtain the coating and are killed by the poison. This mixture has the advantage of low cost and improved spreading qualities. Cornstalks ground in a hammer mill may be substituted for sawdust without reducing the effectiveness of the bait.

County agricultural agents are in charge of campaigns for the various counties, and will instruct community leaders in the methods to be employed. Supplies will be furnished by the grasshopper and Mormon cricket control project and mixing stations will be set up to prepare and sack the mash. From there it will be distributed by truck to infested areas and scattered evenly at the rate of 10 to 15 pounds (wet basis) an acre.

Bait is spread when the hoppers are taking their first meal of the day, between 6 A.M. and 10 A.M. Control is more effective when they are still on their hatching grounds or massed along field margins, or before they exhaust the food supply in a particular vicinity and migrate to cultivated

land. If control is delayed until after the hoppers grow wings, it will not be as successful.

Last year more than 153,000 tons of poison bait, costing $2,500,000, were spread over about 25,000,000 acres in 24 states, through the co-operation of the states, the United States department of agriculture, local agencies and 235,000 farmers. It is estimated that crops valued at $128,000,000 were saved by co-operative control work and the $48,000,000 crop damage was materially less than in any year since 1934, when these insects became a national problem and federal-state control work was started.

Weeds Die in Silo

Condensed from Michigan Farmer

AFTER carrying on experiments over the past three years, burying weed seeds in silage, T. E. Woodward, of the USDA, says the advantage of "weed control" may be added to the many other advantages of siloing the hay crops. He tried 26 different kinds of seeds, burying them in separate bags while the silo was being filled, at depths varying from 14 to 30 feet below the surface, and in silages of different moisture content. He tried his experiments in corn, alfalfa, and grass-and-alfalfa silage, made with and without molasses. As the silage was fed out he recovered the seeds and tested them for germination along with duplicate samples he had kept in his office. Only three kinds—bindweed, Lespedeza sericea, and American dragonhead mint,—showed any life after being buried in the silage, and that did not run over 11 per cent at the highest.

The 26 kinds of seeds tested included shepherd's purse, chickweed, buttercup, dandelion, bigseed lady's thumb or Pennsylvania smartweed, goose grass, amaranth, crabgrass, common ragweed, pigeon grass or foxtail, quackgrass, corn cockle, India mustard, perennial sowthistle, oxeye daisy, Johnson grass, lespedeza sericea, bindweed, sweet clover, American dragonhead mint, Canada thistle, horse nettle, leafy spurge, perennial pepper grass or white-top, timothy, and oats.

—*Michigan Farmer*

Hybrid Chickens

Condensed from Successful Farming

John Airy

NEW, vigorous, high-producing hybrid chickens, bred by methods now commonly practiced in the growing of corn hybrids, have just been announced. These birds are crosses of inbred strains of chickens just as hybrid corn varieties are crosses of inbred strains of corn.

Last year, on nine typical Iowa, Illinois and Indiana farms, 436 of the new hybrid pullets averaged 46 percent more eggs than did an equal number of purebreds handled under the same conditions! In addition, the hybrid pullets showed higher livability, matured earlier, produced larger eggs, and excelled in non-broodiness.

Simple breed crosses involving no inbreeding should not be confused with the hybrid chickens. Breed crosses, sometimes called hybrids, are common in England and parts of Europe and have been offered for sale in this country for several years; while often they are superior to purebreds, they lack the desirable characteristics which can be bred into crosses of inbred strains.

The Pioneer Hi-Bred Corn Company of Des Moines, Iowa, is responsible for the development of the new hybrids. At its poultry-breeding farm, which is under the direction of Raymond Baker and his able assistants, Henry B. Wallace and Orris Oshiem, inbreeding and crossing experiments have been in progress since 1928.

White Leghorns, White Wyandottes, Rhode Island Reds, and other breeds representing as much as five years of inbreeding (brother-sister matings) can be found in the Pioneer breeding pens. Although inbred birds generally lack vigor and size, inbreeding serves to unmask the presence of any undesirable characteristics in the original parents. Inbreds from such parents are eliminated, and only those that possess a desirable inheritance are retained for crossing.

When good inbreds are crossed (several strains may be combined in order to obtain as many desirable qualities as possible), the result is quite different from an ordinary breed cross. Because inbreeding and selection have eliminated many undesirable characteristics, uniform birds having the good points of each of the inbreds involved in the cross are produced. However, even good

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inbred strains may not "nick" well with each other, and hundreds of different crosses must be made before superior combinations are found.

Hybrids which seem promising in Pioneer tests are produced in larger numbers the following year and placed with farmer co-operators. These co-operators are then requested to purchase an equal number of purebred chicks from another source so that a comparison may be made. While last year's co-operators found that the new hybrids produced 46 percent more eggs than their purebreds an equal increase is not to be expected under all conditions. The purebreds used for the comparison were the ordinary run of hatchery stock and as such were not exceptionally high producers. However, other comparisons with far-above-average purebreds would indicate that at least a 20-percent increase is probable.

When you will be able to buy the new hybrid is not yet certain. The Pioneer Company states that it will not be able to fill orders this spring and is not willing to suggest how many chicks will be offered for sale in 1941. Inbred foundation strains must be developed in larger numbers before large-scale production is possible.

The United States Department of Agriculture and several experiment stations are initiating programs to develop superior strains by inbreeding. However, before other strains of hybrids can be made and proved, at least five years must be spent in inbreeding and testing.

Pastures

The application of proper fertilizers increased the yield of grass by as much as 10 tons per acre in numerous test plots checked in 16 counties by the Pennsylvania State College last summer, This was in spite of a severe drought. The treated areas produced 10 to 12 tons of grass per acre on a green basis with a protein analysis of nearly 24 percent. The untreated areas produced from 1 to ½ ton of green matter per acre, which analyzed only 12- to 15-percent protein.

—*Successful Farming*

Chemurgy — The Farm Feeds the Factory

Condensed from Farm Journal and Farmer's Wife

Robert West Howard

CHEMURGY is a new word. Pronounce it *Kem'-er-jee.* Not more than a century ago people were learning how to pronounce *lok'-o-motive.* Twenty years ago, we were learning to say *ray'-dee-oh.*

Chemurgy is a coined word, jerrybuilt from two Greek words that mean "Chemistry at work." It means that, but the movement behind it is more than that. The scientists and industrialists and farmers who have been exploring Chemurgy for fifteen years now know that there is a big and boundless future for agriculture if chemistry is worked hard enough. And this year there's enough evidence at hand to prove that they knew what they were talking about when they formed the Council in 1934.

Take a panful of beans. Add water, boil them down. It's almost a soup. Then, instead of adding salt and pepper, put that almost-soup into a steel box, bring the temperature up to white heat, force in hundreds of pounds of pressure and introduce a powerful element that will tear those beans back into atoms. That's Chemurgy. And what have you got? Well, you can have a doorknob, or a steering wheel or a gear-shift. Or you can force the proteins of that chemical soup through a thousand tiny holes and weave the result into a necktie or a new pair of pants. Whatever you do, it's Chemurgy, a non-food use for farm products, the land moving forward feeding the factory.

Take a mental squint across the Corn Belt, eight states wide. Until the chemurgically potent soybean came along ten years ago, corn was the major crop. It still leads there today, but it still feeds more than 90% of its golden yield back into farm flocks. Less than 3% of the total U. S. corn crop went into industry in 1939. But meanwhile, in private laboratories and in government laboratories, scientists have discovered 56 industrial processes in which the starches, dextrins, syrups, sugars and oil bound up in every kernel of corn can be used. Those uses run from backing for carpets to a binder for dynamite, from bag twine to caramel candy.

Reprinted by permission from Farm Journal and Farmer's Wife, Philadelphia, Penna., April, 1940

And the scientists wipe their hands on their white smocks and say "It's only the beginning."

Chemical processing of farmstuff already provides tons of the materials that industry needs in this age of glitter and speed and hard, rough wear. Cotton roads and road mats; steering wheels from the soybean's chemical soup; patent leather pocketbooks made from the corn syrup; shiny weatherproof furniture from cotton linters; oils from castor and soy beans; textile goods and cold-water paints from milk curds; starch from corn and sweet potatoes.

And in their precise, four-syllable way, the scientists are saying "Folks' it's only the beginning."

The United States produces one-fourth of all the world's oats. Only 2½% of the annual crop goes into oat food products. But oat hulls are the only raw material used commercially for the production of furfural, and furfural makes synthetic resins, purifies wood rosin and is a lulu for refining lubricating oils. Scientists are still poking at furfural and expect to find it will also make a good solvent, a good paint remover, a preservative and a binder for low-cost road construction.

Americian tanneries used to get their tannin from chestnut trees. When the chestnuts died of blight, they began to use sumac and synthetics. Just by chance, a scientist stumbled on to the fact that lespedeza is a splendid, cheap source of tannin.

Straight across the farm-factory front, similar "abra cadabras" can be recited. The basic research has been done. Many of the wheels are already spinning. Others will be ready to roll before the end of this year.

In 1935, when the National Farm Chemurgic Council was formed the wagon wasn't ready for the horse. Charles Herty, working in a sheet-steel laboratory on Savannah's waterfront, had proved that white paper could be made from slash pine, but manufacturers wouldn't believe him. Du Pont was turning out miles of rayon from cotton linters, but it still wasn't quite the thing to be seen in.

That was in 1935. This is 1940. In February, I took a chemurgic trip.

In New York City, the Tennessee Eastman Corporation was previewing new weatherproof, shiny furniture, made in more colors than a gamecock's tail-feathers. Chairs will sell for $17, sofas for $40. They are woven from Tenite II, a cellulose acetate made from cotton linters.

At Newtonville, Mass., across the street from the concrete rut that holds the main line of the Boston & Albany Railroad, di-

rectors of the Atlantic Research Associates are testing the silky, tough wool-like fiber spun from milk by their pilot plant on Rhode Island. Nearly a decade ago, the National Dairy Products Corporation began to frown at the skim milk going down a hundred thousand gutters. They bought out Atlantic Research Associates, set up new funds, began to play with casein, the yellowish powder that makes up the body of milk curds. Now, half New England's highways are safety-marked with casein paints. Plywood strips are held together by the casein glue the Newtonville scientists invented. And before next spring casein fabrics will be on the market to offer competition to imported fine wools from New Zealand, and imported carpet wools from India.

At the Sam Houston Teachers' College in Texas students have put out a school magazine on paper made from castor bean stalks. Castor beans . . . in February manufacturers were importing the beetle colored things from India and Brazil at a rate of 125,000 tons a year. Prices have gone from 60c to $1.05 a bushel. From the castor plant chemurgists expect not only castor oil but insecticides, paints, ointments, soaps, bags, string, "And grow them here in the U. S. A.," they say, insisting on more crops for American farmers to grow and sell.

Back then, across cotton and corn's old kingdoms to the shore of the Great Lakes to talk with men whose grandfathers began to crush farm-grown oil a century ago. "Soybeans . . . a good thing for 1940 . . . Soybeans, going up. . . . Flax. Look out for competition from India. Prices going up. . . . Tung oil. We grow a million lbs. a year, and need a hundred million. China has to sneak her stocks out through French Indo-China this year. Tung oil is 30c. Going up."

Talk turned now and then to the four new surplus-study laboratories Uncle Sam will open this summer, at Peoria, New Orleans, Philadelphia, and San Francisco. The government has joined with Chemurgy, too.

Finally we cut through Columbus soot to the office of the National Farm Chemurgic Council at 50 West Broad Tower and watched the office staff working 12 hours a day to ship test plantings of new seeds into the 48 states . . . seeds that may mean something to agriculture and to factories tomorrow . . . seeds for needed crops like safflower and perilla and chia. Here new ideas buzz daily, the postman unloads his messages, requests pour in for information, conferences are planned, speakers dash out for meetings, booklets are written and

mailed, and back come ideas, hunches, laboratory tests, some screwball, some sound. All to be sifted, and the best put to work to help the farm feed the factories again.

Yes, Chemurgy is on the march.

It needs more talking about. It needs study groups on the land, and a catch phrase like "Self Help." It needs more farm folk going up to the counter to say "Now, see here, I want this stuff made from farm-grown goods. It's being done. I raised the raw material from the ground. You're the processor. Give me the finished job."

It needs that sort of thing, this Chemurgy. The locomotive did—at first. Radio did—at first. Yet slowly, surely, without miracles, it moves forward.

Science and industry and agriculture's team work can't hurry, but so far—

"It's only the beginning."

What Chemurgy Means to the Farmer

Presented at the First Missouri Farm Chemurgic Conference, Sedalia, Missouri, May 14 and 15, 1940

Eugene M. Poirot
Golden City, Missouri

I am the farmer, and my occupation goes back to the time of Adam. My job had to be done more efficiently before man could have more than food. It was only after my farming efficiently had reached a point where one man could produce enough food for two that men were released for making things. It was in this secure cradle of efficient agriculture that inventions were born and industry grew. It was in this same cradle that America grew to the state of a great nation and with it my tribe became less in numbers because they were more efficient. Because we became less in numbers the importance of my job, for a time, has been forgotten. I would therefore have you remember the simple thing I do. I encourage the natural process of combining the minerals of the soil with the air you breathe, the rain that falls, and the sun that shines. The product is all that you eat, all that you wear, and all that you are. My industry hangs by so thin a thread that a fungus with a special and general appetite for chlorophyl (the green of the leaf) could destroy all that lives on the face of the earth and all that is man. His works would crumple in a desert heap.

Because I have become efficient in producing more food than my fellow man would take from me in fair exchange, after I had released him from the toil of the soil, I have had to suffer for want of the things I need. He would not mine for me or haul back on his railroads the fertility I took from the soil to feed him in exchange for more food, so I did not replace it and I have spent 40% of my soil. He loaned me this thing he calls money; I could not eat it or wear it, but he took part of the things I grew that he could eat and wear for letting me carry it around in place of my grains and livestock. And now only about half of my tribe still own the land that is their home, and their machines with which they produce all that man eats, and wears and is. I too have not replaced my timber; there is about 80% of it gone. The water runs off of the slopes pretty fast, and the soil washes a little. But I thought that my fellow men need-

ed it so badly that I gave it to them without asking them to help me replace it and it seems it's a little too late now. I could have paid in food but he already had too much.

I now hear about a different sort of man; he is a chemist. He has been putting things together and taking them apart for years. One time he had a chunk of coal in one of his test tubes, some oil in another, and some one must have paid him off in more farm products than he could eat so he put them in another test tube. And then he went to work tearing them apart, and when he got through he found that they were all made out of the same things. And then he went to putting them back together again and the flock of different things he got was amazing. The thought came to him, why not take these things farmers give me that I cannot eat or wear because I can only hold so much and make them into things people can use? He took $850,000,000 worth of my farm products in 1938.

Thus chemurgy had its birth in the same secure cradle of efficient agriculture as the younger brother to industry and commerce.

I think I am going to like this fellow the chemurgist because he seems to like me. He is not asking so much either by way of the mineral fertilizers of my soil. He wants the starch, sugar, cellulose and oils I can grow and they are mostly sunshine, air, and water. His test tube has no gastronomic limit. I can pay some of my debts with these things, use more of my land and machinery, and get back some of the things he makes. I will continue to feed the people but I will hold back some of my rare fertility elements to make better foods, and this chemurgist fellow will help me buy back some of the fertilizer I borrowed from the soil to stay alive the last twenty years.

That is the story, probably the way it will be unwound behind the stove in the little town of Dudenville. There are many Dudenvilles in this great country that serve a people that many of you do not understand. They have taken the rap of low prices and a shameful exchange economy because it is just another hazard in their life like the hail storm, the drouth, or the flood that sweeps in a few hours a year of work, a year of their life, from their grasp. Some have been forced out by foreclosure, but I have yet to see my first farmer who once owned land, who would not clear away the wreckage, roll up his sleeves to long hours day or night and scoop into the balance one more year of his life with all that he had, and wait twelve months to see if he had won or lost.

Chemurgy, in a way, is a new

thought that may solve serious agricultural problems by making a non-food market for the products of the farmer. How fast it will work no one can tell but according to the figures of National production, one dollar of agricultural raw material is always equal to about $7.00 of National income regardless of the quantity in production it represents. That alone would make it worth the trial and merit the support of the non-agricultural producer, since the ratio is only one farmer to three of him, in place of one to seven.

Missouri's greatest rural problem exists in her hills where the pine has been cut and the tie timber taken. It is too late to think of what should have been done. The problem is there now and it needs the best thoughts of our scientists and statesmen. If on those hills, shrubs or trees out of which drugs, flavorings, or medicines are made could be grown, and if in other more open places such sod crops as lespedeza could be grown for the oil in its seed, and if a perilla seed, which now grows native in many South Missouri river bottoms, could be developed into a non-shattering variety, the income of these people could easily be doubled or trebled since it is so very low now. Last year we imported from the Orient more than 31,820,000 pounds of perilla.

In other parts of the state, castor beans, sunflower seed and soybeans can be grown and the development of small crusher plants within the state would allow the return to the soil of the meal as a fertilizer. These crushers need not be 100% efficient, they could be operated by farmers now on WPA rolls during the winter months. The same kind of local unit could be worked out to separate the starch from the germ of grains, to make separations of sugar and cellulose so as to leave at home the fertility elements taken from the soil and market only the moist air and sunshine. A dream of the future would be a production of a part of the power used by farmers in their tractors and cars. This power was once produced on the land in terms of oats, corn, and hay fed to horses, and it may some day again be produced there.

What, therefore, does chemurgy mean to the farmer? If it is allowed to develop without direction it may mean further exploitation, depletion of our soil resources, and human misery to our farming people. As a Nation we have without knowing it spent 40% of our agricultural resources in terms of soil and soil minerals very necessary in plant growth and human nutrition. We have shipped it across the sea and called it surplus crops, we have flushed it into the lakes and

rivers and called it sanitary disposal, we have allowed it to wash off the hill sides and called it farming. Though agriculture may have in some year been profitable in terms of dollars, it has every year gone into the "Red" in terms of the food growing elements of the soil. The continuation of such insane waste can bring nothing short of National disaster. It violates the first law of life and the only escape is human misery and death.

The farmer is not responsible for this. He can offer only more food for terracing his lands, more food for returning the fertility he took, more food for non-agricultural services, more food for replacing buildings, fences, trees, more food for taxes, rents, machines. More food—and it's dollar value becomes less and less and he offers more food to get more dollars. The withdrawal he makes from the natural resource of plant food minerals becomes terrific and its results are already too evident to need comment here.

The non-farming public fail to recognize the seriousness of this tremendous waste because they are not farmers. Many farmers fail to recognize it because they are not soil chemists. Those few who do can point the way which in my opinion is to be found in the farm production of such industrial raw materials as oils, starches, sugars, cellulose and alcohol that contain very little or none of the valuable soil minerals, with necessary crushing and extracting plants on or near the farm so that the refuse can be returned as a fertilizer to the soil, and the air, sun and water parts sold to the industry that needs them.

Chemurgy directed along these lines by the various chemurgic organizations, means a non-food and non-soil-depleting market for an agriculture that is geared to a production in terms of land, machinery, and men far beyond present food needs. That agriculture needs such a market so that its lost fertility may be recovered and its safe base of abundant production maintained goes without question. That such production approaches a permanence not found in other sources of raw materials is a chemical fact of great economic importance.

The Why of Good and Poor "Doers" in the Feedlot

Condensed from The Ohio Farmer

Ray T. Kelsey

PERHAPS the most common remark to be heard around Ohio feedlots is that certain steers seem to be "good doers" while others are "poor doers." It is apparent even to the most casual observer that some animals in the lot are not putting on flesh or doing so well as others even though they are all getting the same ration and treatment.

Never do you hear a feeder state just why it is that some calves seem to do so much better with the feed given them and another set of calves will not. Most feeders just accept the fact that it is so and are glad when they finally get the poor doers in shape to market and are rid of them. That seems to be all that can be done about the situation once the steers are in the feedlot.

That there is at least one reason why was shown to 300 Wood County cattle feeders at their annual feeder tour and banquet by Bradford Knapp of the U. S. Bureau of Animal Industry. For the past several years the Bureau has been running a test on the performance of beef cattle sires and the results to date indicate that a calf's ability to convert feed into beef is an inherited characteristic. For years the standard of perfection in beef cattle has been judged in the show ring. This series of tests is an attempt to measure the worth of beef animals by the efficiency of the calves which they produce.

The method used is to take steers of different ancestry weaned at a weight of 500 pounds, irrespective of age, place them on feed under identical conditions until they reach a weight of 900 pounds. Records are kept of all feed consumed during the fattening period. Then the steers are slaughtered and quality is determined by carcass grade. The final score for each calf is obtained from both efficiency of gain and carcass quality.

Results in some of the tests have been quite startling according to Mr. Knapp. At one of the stations calves sired by a bull with prize winning ancestry were compared with calves from a bull that would have stood far below him in the show ring. In

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the feedlot test the calves from the first bull required almost twice as much feed to produce 100 pounds of gain as those from the second bull which was considered inferior. The difference in feed costs for the 400 pounds gain was more than $30, yet the calves sold on the market for the same price. Thus, the worth of a beef sire cannot always be determined by his show winnings, the real test is in the performance of his calves in the feedlot.

After all a beef calf is simply a machine to convert farm feeds into beef, just as a dairy cow is a machine to convert feeds into milk, and Corn Belt feeders are primarily interested in the efficiency of the beef making machine. Mr. Knapp urged Ohio feeders to co-operate more closely with range cattle men from whom they buy calves in a movement to weed out the sires which produce the poor doing calves and use only those sires which produce the "good doers."

Continuous Burning to Eradicate Noxious Weeds

Condensed from The Reclamation Era

C. L. Corkins
State Entomologist

A. B. Elledge
County Pest Inspector, Powell, Wyo.

CONTINUOUS burning is still in the experimental stage, but it offers hopeful prospects of becoming cheaper and more practical and efficient than the chemical methods for small patches of weeds under certain conditions. As yet we are only sure of our ground in saying that it is a better eradicant than chlorate on White Top, *Lepidium draba,* and Canada thistle, *Cirsium arvense.* It will kill other noxious weeds, but refinements in our methods will have to be made before it will be cheaper than chlorate on bindweed and Russian knapweed. Our test work was started in 1937. Extensive field operations were started for the first time during the spring of 1939. No fundamental research has yet been made and such important questions as (a) the longest possible allowable interval between applications, (b) the best time to start treatment (c) the proper time to renew treatment the second year, and (d) the exact optimum degree of burning are yet incompletely or wholly unanswered. So it is hoped that this article may not only stimulate practical trials elsewhere, but also initiate research.

When the test plots were inaugurated in 1937, it was thought that continuous burning might work very much like continuous cultivation by depleting the starch and sugar reserves in the root system and by preventing their manufacture in the leaves of the plant. As a consequence, we started by completely burning the plants down to the ground, which was referred to by the workmen as a "tight burn." The reaction of the plants was very similar to a clean cut by a tool at the surface of the ground. In a day or two, new growth "popped" right up and they quickly re-established themselves. A 10- to 14-day interval seemed to be as long as could be left between treatments. The re-

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growth was so rapid and persistent the first year that we became a bit discouraged with the project. This continued until midseason the second year and then results began showing up rapidly. None of the test plots which showed complete eradication has ever since produced any signs of return of weeds. However, the necessity of such frequent treatments made the method doubtful as to practical value. And then one of the county pest inspectors reported the unusual results of an entirely accidental experience.

John Hendreschke, county pest inspector of the Eden Valley, Wyo., was burning a patch of bindweed which had developed mature seed. The growth was heavy and thick and John was doing a good job of burning it. In fact, he was doing such a good job that by the time it was half done his burning fuel had been three-fourths used up. So it was a matter either of making a long trip after more fuel or taking a chance on getting the job done with a rapid, light burning. He chose the latter and proceeded to quickly sear the tops of the plants on the rest of the patch.

John got his surprise when he went back to treat this patch the next summer. The part which he had given a "good job" of heavy burning seemed to have been stimulated by the treatment and the growth was heavier and ranker than before. The part that he had given the "poor job" of light searing of the top foliage was thinned out at least half and the remaining plants were sickly and weak.

Thus John Hendreschke became the father of the light searing process, which has led the way to the practical application of the burning method. In treating 889 patches of weeds at Powell last year, aggregating 18½ acres over a 101-mile route, the intervals between burning were lengthened out to 3 to 5 weeks, and none had more than 5 treatments. And the results were far better than with twice as many applications of the tight burn.

It seems that there is some action produced by the light sear besides starch starvation. After treatment, the roots die down into the ground several inches and the plants have a physiological setback. Just what the action may be is not known. When the deeper roots start dying, they appear as dessicated as if they had been dried out in a hot oven. They look entirely different from dark brown decayed roots, which have been beset with bacterial rot, produced by continuous cultivation.

The first burning is given at the prebudding stage in the spring. This is when the starch reserves are the lowest and the roots in the poorest condition to

stand a shock. Whether it is safe to let the plants regrow this long before a second treatment is given is not known. We take no chances and sear them again a couple of weeks ahead of the pre-budding stage. It is believed there should be a fair amount of foliage always present to sear. The plants are allowed to reach the pre-budding stage again the second spring of treatment before burning is started.

With this method, as with continuous cultivation, there is a wide variability even on a given weed species, in their resistance to treatment. It is impossible to predict just how long it is going to take to kill a patch of weeds. During the 1939 season of initial treatments, when 5 burnings were given from May to October, 43 plots were eradicated, 267 more than 90 percent killed, and the balance of 579 showed definite signs of weakness. It is indicated that the average number of burnings required will be about 8 or 9 over a 2-year period for White Top and Canada Thistle. Some will doubtless require more treatments and a few will probably take 3 seasons to completely eradicate. There has been one very prominent factor of variability noted. Weeds on dry areas react more quickly to burning than those in moist or wet situations. This may be correlated with volume of root system, but such does not yet appear to be at all certain.

We now feel very hopeful about one important experience with the burning process, namely, that when eradication is indicated as completed by no return growth over a season's period, eradication is really an accomplished fact. Surface readings of results apparently tell an accurate story. Such is not the case with the chlorate method, for it has been our sad experience that regrowth shows up too frequently when the job was thought completed. Retreatment of chlorated areas often drives the cost of this method two to three times as high as the initial treatment. One cannot be sure for several years after no new growth has come up that a chlorated weed patch is eradicated, and at times we are doubtful if one ever can be sure.

The lay-out of the plots for a burning job is exceedingly important. An entire unit of infestation must be completely treated. If one burns only part of an infestation it will be found that on the edge next to the untreated area, unharmed roots from the untreated plants will grow underneath and into the treated area at least 6 feet a year. So if burning is being used along a fence row or ditch bank adjacent to an infested field, it is imperative that the field be treated by continuous cultivation at the same time.

Unit statistical data on field operation can be based on only the one initial year of experience we have had so far. This was under public operation in a pest district, where all cost factors had to be considered and the project placed on a large scale of operations over a wide area. Large power equipment, which is described later, was used. An average of 0.95 gallon of burning oil was consumed per square rod. With refinement in the burning equipment, this was cut to 0.42 gallon per square rod for the last treatment. The total average time required per treatment per nozzle per square rod was 6.4 minutes. It is estimated that loss of time in moving the equipment between patches and the making of records accounted for at least half of this time. One man can and should actually light sear a square rod in 2 to 3 minutes. The average cost factors per square rod per treatment were: Labor, 5 cents; burning oil, 2½ cents; machine and mileage, 2 cents and administration 1½ cents making a total of 11 cents. If the number of applications necessary is 8, the total cost of eradication would be 88 cents per square rod.

This method is especially applicable to the individual farmer's use, as the only important cash item of expense is the fuel. The necessary equipment is cheap, as a home burning outfit can be rigged up for $15 or $20 and may and should be used for other purposes, such as burning annual weeds in waste areas and spraying the garden and orchard. Thus, if this method of eradication is put on a cash outlay basis for the individual operator, it will run only about 16 to 20 cents per square rod for eradication.

The equipment is designed to burn a very low-grade fuel. Perhaps the most satisfactory fuel is furnace oil, which costs 4 cents per gallon in our area and is generally cheap in the Western States. The more common fuel used in Wyoming is refinery bottom refuse, which is ordinarily a waste product of small cracking plants and runs from 28° to 38° Baumé. To the lower grades is added from 5 to 10 percent distillate to thin it and raise the flash point. This product usually sells at about 2 cents per gallon. Our experience indicates that it is very little cheaper than furnace oil, because it does not completely burn up and more is used per unit area. Some feel that the residue left on the foliage from the use of this oil may be of herbicidal value, but this is doubtful.

This fuel is burned by running it through a pressure spray pump at 75-pound pressure for the furnace oil and 125-pound pressure for the refuse. The burning gun is merely a 12 foot ¼-inch iron or copper alloy pipe, with a Chip-

man or other spray gun cut off at the operator end and a $\frac{3}{64}$-inch Chipman weed disk in the flame end. A loop is placed in the rod at the flame end in order to preheat the fuel with its own flame before it is ignited. This loop should be constructed so that the oil is thoroughly heated, *but not vaporized*. It is important that the Chipman type of disk be used, as it will throw a broad, flat flame that cannot be secured by any other type. It should also be pointed out that extensive trial has shown that the size of the disk outlet cannot be smaller than indicated and a larger one will simply waste fuel.

Three types of spraying equipment are used to meet varying conditions.

1. The junior size model, 2 horsepower, high pressure spray rig is adaptable to public programs, and will easily run two guns. Larger equipment is unnecessary. This rig is mounted on a truck, and is particularly adapted to use on roadsides and dry waste areas. This outfit can be rigged up for about $300 without truck.

2. A light power spray rig with a ½-horsepower air-cooled motor, mounted on a rubber-wheeled light trailer and drawn by a single horse, is best adapted for public programs on irrigated farms and waste areas inaccessible to the truck equipment. The wheel mountings of the trailer should be adjustable, so that the rig can be taken through row crops without damaging them. This is a one-man outfit and can be made for about $100 complete.

3. The hand orchard type of sprayer is cheap and handy for the individual farmer. The pump may be mounted on a steel drum and constructed complete for not more than $20.

Of course the common generator types of burners may be used, but they are both slow and dangerous to operate. We have eliminated them as being entirely impractical.

The degree of burning of the foliage of the weeds is so important that it should be re-emphasized in closing. The flames should be passed rapidly over the tops of the plants so that they are so lightly seared that they will not wilt until the next day following treatment.

Feeding Farm Horses

Condensed from The Rural New-Yorker

R. W. Duck

IN the interest of economy it is desirable to make maximum utilization of available roughage for idle mature horses.

The quality of hay fed is more important than the kind. If good quality legume hay is used horses may be fed up to one pound per head daily for each 100 pounds liveweight, preferably such hay to be fed in the morning, then feeding straw at evening. Bean and pea vines and pods are usually very dusty, and if fed for long continuous periods may cause horses so fed to develop heaves. This common ailment is due to accumulated fine dust particles producing a partial paralysis of the lungs. When the breath is expelled it may be accompanied by a local spasm, which can be noticed near the last rib and flank. Heaves may not seem to be serious, but horses so affected tend to tire easily and have a greatly lowered working efficiency. If dusty hay is dampened before feeding it will help prevent possible excessive breathing of dust.

If straw or corn-stalks only are available, and it is imperative that they be fed, then idle horses should be fed small amounts of a suitable protein supplement beside having constant access to a mineral mixture. Horses often will not touch any material or feed which has an unusual odor. For this reason steamed bone meal may be replaced in their mineral mixture by spent bone black or dicalcium phosphate. A suitable mineral mixture for horses would consist of iodized stock salt 50 lbs., ground limestone 25 lbs., dicalcium phosphate or spent bone black 25 lbs; commercial iron oxide 3 lbs., flowers of sulphur 2 lbs. This should be kept in a clean dry container where the horses can eat it as desired.

If protein and mineral needs are regularly supplied from supplemental sources the results from straw or other inferior roughage need not be so adverse. The idle horse has a relatively low digestible protein requirement; most authorities agree this is somewhere between 0.5 and 1.0 pounds daily per 1,000 pounds bodyweight. Twelve pounds of good quality legume hay and six pounds of oat straw will on the average supply sufficient digesti-

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ble protein and other needed nutrients in proper ratio to keep an idle horse, weighing about 1,000 pounds, in condition and health. Based on the digestible protein content of oat straw of slightly less than one per cent it is seen that an idle horse weighing 1,000 pounds would need to consume an average of 100 pounds daily to meet its digestible protein requirements. While no doubt idle horses wintered around straw stacks as the exclusive source of nutrients do devour enormous amounts of such roughage daily, as is later attested by their protruding abnormal bellies, it is doubtful if even they continuously eat more than half to one-third this amount. The addition of one pound daily of linseed oil meal (old process) would just about meet their requirements as far as protein is concerned.

Dairy cows should be fed in proportion to production, fattening animals in proportion to desired gains, growing animals in ratio to rate of growth and gain desired· and horses in proportion to work being performed. On idle days and over the week-end it is in the interest of economy as well as the health of the horses to allow them access to a paddock or field, and to reduce their grain ration materially; it may be discontinued entirely on the evening preceding an idle day. In its place many good horsemen feed a bran mash. A mixture of one-third wheat bran and two-thirds oats is an excellent light nutritious feed for horses doing light work or for idle horses.

Experimental tests show that if horses doing heavy work receive a daily ration of one to one and one-half pounds of suitable grain and one pound of good quality hay per 100 pounds liveweight, it will be sufficient to keep them in good condition and working thrift. For light work the hay may be increased about one-half pound per 100 pounds weight and the grain reduced approximately 50 per cent. For medium work the general requirements are one pound of grain and one pound of hay for each 100 pounds bodyweight.

If the manger is piled full of hay at each feeding horses will usually eat more than needed or desired for best returns in health and work. They will do better and perform more efficiently if the total hay allowance is fed at the rate of one-half at the evening feed, the other half being equally divided for the morning and non feeds. The grain ration allowed is best distributed at the rate of one-fourth at the evening feed, and equally dividing the remaining three-fourths into the morning and noon feeds.

Available grains will always be the most important determining factor relative to their use and

proportion in which fed. Wheat-bran and oats are especially desirable and suitable for horses, and if not continuously fed should be used occasionally as previously mentioned.

Probably one of the most frequent nutritional causes of cramp-colic is the manner of salting horses. Both digestion and assimilation are assisted by a proper and constant supply of sodium and chlorine. Common salt, sodium-chloride (NaCl) is the least expensive and gives the greatest nutritional returns of any supplement. The amount needed will vary with the kind of work performed, weather conditions, chemical content of the feeds consumed, age and size of the animals. Therefore, it is advisable to have a constant supply of salt available so that livestock may adjust their intake to suit their own physical requirements. If allowed constant access to salt, mature horses will consume an average of about one ounce daily per 100 pounds liveweight. If goiter, navel or joint-ill is occuring it has been found that iodized stock salt acts as a corrective and preventive. The continuous use of iodized stock salt for stallions, colts and brood mares has been found to be especially beneficial. Salt should be kept available in a clean, dry container, separate from the rest of the feed.

Based on the considerations mentioned, some common feed mixtures suitable for work horses with different kinds of hay as indicated are: (1) Corn, oats and barley, equal parts, suitable for feeding with mixed hay. (2) Corn, two parts, oats, three parts, with clover hay. (3) Corn, three parts, oats, two parts, with alfalfa hay. (4) Corn three parts, oats, three parts, wheat-bran three parts, linseed oil meal (Old Process) one part, with timothy hay. (5) Corn and oats, equal parts, with legume hays. (6) Chopped straw or shredded corn stalks (over which is poured one pint of cane molasses each feed, diluted with an equal volume of warm water), grain, corn or oats eight parts, soybean meal one part.

Brood mares and stallions need a light, nutritious concentrate feed without too much roughage or they may develop a hay-belly, become too heavy in the middle, and produce foals which lack sufficient stamina, strength and bone development. A 1,200 pound brood mare carrying a foal can utilize up to about 16 pounds of good quality legume hay and six pounds of oats to good advantage daily. If prairie, mixed or timothy is used for mares of this weight consuming 16 pounds daily, a good grain mixture is corn five, oats three, wheat-bran two, and linseed meal one part by weight, fed at the rate of six pounds daily.

In a high percentage of cases farm horses are rather thin and run down when Spring work arrives; and it will pay to have them gaining for from four to six weeks prior to starting on Spring work. The corn, oats, bran, linseed meal mixture is good to get them fitted and will help them shed their long hair.

If the shoulders of horses or mules which have not shed are clipped it will be of help in preventing sore shoulders. Most horsemen are not advocates of complete clipping in the Spring, as it may cause chilling and cold infections. When first started to work in the Spring it will be of help in hardening the shoulders to bathe them at night with strong salt water solution. They should then be thoroughly dried. The fit of the collar is another important factor in working efficiency and sore shoulder prevention. If the collar is extended about two inches below the throat it will premit proper breathing on a hard pull. If the fingers can be easily inserted between the neck and collar it is approximately correct for fit. Care relative to these factors for the prevention of sore shoulders should be observed when first starting Spring work. Keep hair and dirt scraped from the collar, and wash with saddle soap and water; a properly fitted collar needs no padding. If necessary to pad a collar which is too large a light pad with smooth surface is preferable.

Sow Testing in Minnesota

Condensed from Hog Breeder

H. G. Zavoral

University of Minnesota

THE object of sow testing is to develop strains of hogs that will give the best returns over feed costs per 100 pounds of gain. It is a method of finding and selecting the most profitable breeding stock. The continued testing of sows is an important factor in developing strains that will have an inherited rate of rapid and efficient growth.

A record of performance test for sows was begun in Minnesota in 1929. Breeders of purebred hogs were invited to send four pigs, two barrows and two gilts, from one of their best litters to the experiment station at weaning time or when 56 days of age. Since prolificacy is an important factor in hog production co-operators were asked not to send pigs from litters unless there were at least seven pigs weaned from a gilt and eight pigs from an older sow.

The four representatives from the same litters were fed a standard ration at the experiment station until they reached 225-pound weights. At this weight three of the four pigs were slaughtered and a careful study made of the carcass to determine how closely they met market demands. In addition to the records of the rate and cost of grains obtained during the feeding period, the breeder reported the weight of each pig of the litter at 56 days of age. In this way a measure of the uniformity of the litter was established.

From records obtained over a period of three years, differences in feed costs, in gains, and in carcass values of purebred hogs were studied. It was found that there was a difference in daily gains of slightly more than one-third of a pound per pig and a spread of 72 pounds in total feed required to make 10 pounds gain. There was also a variation in average dressing percentages of 4½ percent, and a difference of 86 cents in the average value of carcasses, calculated upon 100 pounds of live weight of a finished hog. The average daily gain per pig ranged from 1.10 to 1.64 pounds and feed totals for 100 pounds of gain varied from 345 to 409 pounds, and a difference of $2.00 in the value of a 225-pound hog carcass showed up.

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These facts clearly pointed out that there was a difference in the strains of hogs regarding feed costs and carcass values. Thinking along this line paved the way for a method in selecting breeding stock. It was agreed that since hogs are graded on the hoof and not on the hook, the producer is looking for the heaviest hogs in the shortest time on the least amount of feed. Just how much of a hog's ability to make rapid, economical gains may be attributed to inheritance is hard to answer. But because dairymen have made progress by continually keeping breeding stock from the highest producing dams, there appeared to be no reason why hog producers could not do the same thing. The nearest approach thus far devised toward that end is what is known as sow testing.

A Minnesota sow testing project was organized in 1934. A suggested system of ear marking, a record blank for litters and an outline of the objects of the work were sent to prospective co-operators. Sixty-three farmers from 12 counties signed enrollment cards signifying their intention to cooperate.

This project, however, workable as it might appear to be ran into many practical difficulties. About 20 percent of those who signed up did not mark the pigs. Another 20 percent did not weigh at weaning time, and only about 25 percent did both the marking and weighing at weaning time. Very few weighed the pigs at 180 days, but of course that is much more difficult than weighing at weaning time.

However, it was a start and some practical results were obtained. The county agents and specialists were busy doing educational work for the triple-A program and very little time was available for other work. Hogs were low in price and it was hard to maintain interest in sow testing. But some of the original cooperators signed up again, and a few new swine raisers joined them.

Results from this effort after three years' experience showed that some litters weighed much more than others at weaning time, even when difference in size of litters was allowed for. The heaviest litters at weaning time continued to be the heaviest throughout the growing period. Sows were culled on the basis of weight per litter at weaning and gilts for breeding were selected from these heaviest litters. Cooperators reported marketing their hogs in 6 months instead of 7 and 8 as formerly. One man reported 210 pound pigs in 5 months. He attributed the increased weights more to the selection of breeding stock than he did to better feeding. The producers that followed sow testing

were sold on the results. The trouble lay in that only an insignificant number would cooperate. They just would not do the necessary work themselves. This, we learn, is also true in cow testing. If a regular tester does not come around to do the detailed work, farmers will not do it.

Consequently, out of this experience we felt that a new approach was needed. On April 1, 1937, a livestock record association was organized in Fillmore and Houston counties. Forty-five farmers signed up to pay a full-time fieldman to do sow testing, cow testing and supervise farm records. Blanks for sow testing were provided. Each litter of pigs was to be marked at birth and weighed at 56 days as provided by the former plan. The main difference between this and the earlier, less successful attempt was that a regular fieldman was available to do the weighing and promote the project generally. The fieldman was paid by the farmers themselves. In this project the livestock specialists were given an excellent opportunity to do educational work with individual producers. Several meetings were held with the co-operators both in the spring and in the fall. The fall meetings were in the form of demonstrations.

At the fall meetings the pigs were divided by litters and the breeding gilts for the coming year selected from the best litters as a method demonstration. Such selections were made from litters that averaged 7 or more pigs per litter, and that were uniform in size and type and the heaviest at 180 days of age.

The heaviest pigs at weaning time, with few exceptions, were found to be the heaviest at 180 days. Pigs weighing less than 30 pounds at 56 days were found to make gains too slowly and it took them too long to reach market weights. On farms where the pigs weighed 35 to 40 pounds at weaning, 200-pound weights were reached in six months. Good feeding and management of course are large factors, but there was a definite correlation between heavy weaning weights and early marketing weights. The good milking sows produced the biggest pigs.

Most of the same co-operators, with some new ones, continued this sow testing program in 1938. The same fieldman supervised the work and pigs were earmarked and weighed on 37 farms. Some of these pigs were sired by boars from tested sows.

A great deal of interest is being exhibited by these co-operators as shown by the fact that they continued the work in 1939 without a fieldman. They know by comparison that there is a great difference in the weight of

hogs at a given age. They have the third generation of pigs from selected sows and are beginning to talk about inherited capacity for efficient gains. One producer who used a boar from a good heavy litter marketed his pigs at 5 days short of 5 months, weighing an average of 200 pounds.

At the sow selection demonstration meetings last fall, farmers with slow-growing, late-marketing pigs inquired about purchasing gilts from persons who weighed their litters. Co-operators with good records inquired about even better boars from tested herds. Some of these men do not hesitate to pay a good price or go a long distance to buy a boar to be used in a herd maintained entirely on a market hog basis. It will pay purebred breeders to keep weights on their pigs, at least at weaning time. Danish farmers have followed this system of selecting their breeding stock for more than 20 years. But they also go one step farther and select them for economy of gains and carcass requirements. Our system for the present depends principally upon weights. If it proves out, and we have every reason to believe it will, we will then pay more attention to market requirements.

Fifty sets of four charts each have been prepared for the use of county agents in helping them explain sow testing work. Chart No. 1 explains the ear notching system, chart No. 2 shows record sheet for litters, chart No. 3 is devoted to 56-day weight selection, and chart No. 4 discusses litter history and advanced pedigree requirements.

Sow testing will continue to prove that there is a difference in hogs. Our records show that some sows will produce twins and triplets weighing 20 to 30 pounds apiece at weaning time and only 150 pounds at 6 months of age. On the same farms other sows will have 10 to 12 pigs at weaning time weighing 50 pounds apiece and over 200 pounds at 6 months of age. Before purchasing boars for future use, swine growers will want to know more and more about the record of performance of their ancestors.

Good Summer Management

Condensed from American Poultry Journal

Dr. Cliff D. Carpenter

POULTRY death rate can be reduced 50%, if known and approved measures of control are put into active practice.

Let us consider some of these profit-making factors. Management, alone, offers a splendid opportunity for applying these profit savers.

High egg prices in the fall and winter months permit profit taking from pullets; the spring months are profitable chiefly as the result of continued high production; but if we stay in the black during June, July, and August, we must see that our layers are housed comfortably. Hot weather not only tends to lower production because of lessened food intake, but resistance against disease is lowered, and if the temperature gets too high, improper housing causes death by suffocation. As the outside temperature approaches 90 degrees, cross ventilation should be supplied by removing the windows under the droppings board. In any event, see that the windows opposite the front of the building are open. The fear of drafts causing colds is not well founded, since it now is known that without the presence of cold-producing germs, they will not occur.

In extremely high temperatures—anything over 100 degrees—it may be necessary to wet the litter. Likewise, the house temperature may be lowered by sprinkling the roof. The signal for immediate action is when hens are found "panting," and holding the wings away from the body.

If constantly housed, crowding is to be avoided by providing sufficient floor space per bird: 3½ sq. ft. per bird for the light breeds and a minimum of 4 sq. ft. for heavy breeds. Shade in the yards should be provided for layers which run out of doors, and plenty of feed hoppers and waterers should be placed in shady, cool places to encourage greater mash and water consumption during this critical period. Any great decline in the amount of food eaten now will reflect quickly in egg production and may cause a premature molt. During warm weather, it may be necessary to limit the amount of grain fed to hold mash intake at the proper level. Not only is this necessary for satisfactory egg

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production but also for maintaining a high level of disease resistance as well.

Some poultrymen move their layers outside to range shelters during the summer months. Such a practice can be recommended if adequate nest space is provided. The nests are cooler, and emptying the house allows more time to prepare adequately for the early pullets.

Culls are never profitable, and the early summer is a good time to market those which have quit laying as well as the "off" birds. Getting rid of the boarders now will reduce the feed bill and permit greater attention to the oncoming pullets. Likewise, a higher standard of health is maintained when good culling is practiced.

It will pay well to keep in mind that once grass has been jointed, it has lost much of its feeding value to laying hens. If practical, it is advisable to make several plantings of cereals, such as barley, oats, or other blade crops to provide young tender greens. Growing alfalfa makes an excellent range. Layers should be limited to several hours a day on these ranges, or egg production may drop, since large amounts of green feed discourage adequate mash consumption.

Layers cannot make a profit if infested with parasites. A well sprayed house and clean litter will return profits at this time of the year and keep mites from getting started. Remember to spray the walls, roosts, and droppings board, for these tiny parasites breed in dark, out-of-the-way places. Except in severe infestations, these blood suckers attack only at night; preferring to remain hidden during the day time. These nocturnal habits may cause them to be overlooked until much damage has been done.

Lice are controlled best by painting the roosts and crossarms with nicotine sulphate preparations. The material should be applied with care, about one-half hour before roosting time. As soon as it is dark, all stragglers should be placed on the roosts. Just a few birds which perch on the nests or feed troughs, or remain on the floor, may harbor enough lice to reinfest the whole flock in a few days.

Since adult female lice deposit their eggs on the shafts of feathers, and further, since the nicotine fumes will not destroy the eggs, it is essential that the roost painting be repeated on the 10th or 11th day following the first application.

If the flock is small, the house too open, or the birds are roosting out of doors, then individual treatment should be resorted to.

Internal parasites that may produce summer damage include roundworms, tapeworms, and coccidia. An examination of sev-

eral dead or killed culls will reveal the roundworm and tapeworm situation. The intestines should be slit open their entire length. The roundworm will be seen as slender, round, grayish-white worms, pointed at either end and from 1½ to 3½ inches in length.

Roundworms are readily removed by using an efficient expeller. There are several available in tablet or individual form, and powder or mash treatment, which can be used without disturbing egg production. Such treatment should remove 95% or more of the roundworms. Since there is no practical method of destroying round-worm eggs, the treatment should be repeated as often as necessary. Rotation of yards, or a triple range system will do much toward eliminating the roundworm hazard.

If the tapes are large enough, likewise they will be seen readily, appearing almost white, flat, and segmented. The length of the tapeworms will depend upon their age and species. Carefully rinsing the opened intestine in water will wash away the normal contents and disclose the tapes, since their heads are attached firmly in the walls of the intestine. It is by this means that they keep their position in the food stream, and likewise, this peculiarity which makes their removal so nearly impossible.

There are several marketed products which will remove the segments, but the control of tapeworms is largely a matter of prevention by eliminating flies, dung beetles, sow bugs, and other insect life in which the tapeworm spends part of its normal life cycle. Without these insects, tapeworms cannot get a foothold in a poultry or turkey flock.

Daily removal of droppings or sprinkling the droppings board or manure pit with gypsum or superphosphate discourages the breeding of flies. Liquid milk products and wet mashes should be fed in separate containers during the summer months, and as soon as the contents have been consumed, the containers should be removed, washed, and left in the sun until needed the next day. Many poultrymen feed supplementary pellets instead of wet mash to avoid this menace.

Coccidia, which produce coccidiosis, are tiny, microscopic parasites, and in the adult fowl, usually attack only the intestines. (The cecal, or blind pouch type, is more commonly seen in brooder chicks and growing pullets.) Since the egg stage of this parasite also lives in the soil and remains active for many months, rotation of yards and ranges is likewise an aid in keeping these small organisms from stealing summer profits. A milk flushing mash, repeated at intervals, will

assist in checking intestinal coccidiosis.

Control of adult mortality begins as far back as chick rearing and pullet growing. Your adult mortality in the summer of 1941 will depend to a great extent on the care and management you give your growing stock this summer.

An observance of the control measures herein discussed will do much toward avoiding a premature slump in egg production, and will help to guarantee a profitable summer season. The single limiting factor in poultry profits is not the cost of feed; nor the price received for a dozen eggs: it is adult mortality.

A Note on Kudzu

IN less than a decade kudzu, introduced from Japan some 50 years ago and commonly called a "porch vine," has been transformed into an important field crop in the Southeast. Since the beginning of erosion-control projects, more than 40,000 acres of eroded land have been planted to this once ornamental plant.

Kudzu is especially adapted to Southeastern soil and climatic conditions and is not seriously affected by droughts. It will not grow well, however, on poorly drained areas of acid soils or on low marshy lands. The plant is a deciduous, viney legume which grows rapidly during spring and summer months. Kudzu restores fertility to the soil by adding nitrogen and organic matter and it maintains a stand over long periods without yearly soil preparation and planting. It grows vigorously on eroded land after it is well established and with a dense ground cover kudzu protects the soil against beating rains. Not only is kudzu especially suited to reclaim badly eroded slopes in cultivated fields, but it also produces a palatable hay and forage of excellent quality; its feeding value is as high as that of alfalfa and produces larger yields than most annual plants grown for hay. Kudzu can easily be eradicated, thus eliminating the danger of becoming a pest.—*Soil Conservation*

Soil Organisms to Fight Disease

Condensed from New Jersey Farm and Garden

William H. Martin

N. J. Experiment Station

THE fancies of medical men and popular writers on scientific subjects were recently captured by the announcement by Dr. Rene J. Dubos, of the Rockefeller Institute for Medical Research, that he had isolated a substance with tremendous power for the destruction of pneumococci, streptococci and certain other disease-producing bacteria. Production and application of this substance are still in an experimental stage, but it holds promise of being on a par with sulfanilamide and sulfapyridine, which have attracted so much attention recently.

Less well known is the fact that Dr. Dubos received much of his early training in our soil microbiology laboratories and that his discovery is a direct outgrowth of the work he did while at the Experiment Station under the tutelage of Dr. Jacob G. Lipman and Dr. Selman A. Waksman. The substance he has discovered is produced by a soil-borne organism. The active substance is now obtainable in crystalline form; the next problem is to obtain a proper solution of it so that it may be injected.

At the Experiment Station, of course, our direct concern is with agriculture rather than medicine. Nevertheless, Dr. Dubos' announcement serves to emphasize what scientists have long recognized—that there are no sharp lines of demarcation between the various fields of research. One soil-borne organism produces a substance which can protect man from the ravages of disease. Another may perform the same protective functions for the lower animals and a third for plants. As a matter of fact, many such hostile relationships are already known.

The field appears so promising from the agricultural as well as the medical standpoint that we have just inaugurated a new soil microbiology project entitled "The Antagonistic Interrelationships Among Microorganisms." Under this project we hope to learn new and useful facts about the ceaseless warfare which goes on in the soil and to develop ways of applying these facts for the benefit of agriculture.

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Establishing Alfalfa

Condensed from American Agriculturist

J. S. Owens

Connecticut State College of Agriculture

ATTENTION to a few details will practically insure a stand of alfalfa. Except that the omission of certain treatments is more likely to invite failure, there is little difference between starting alfalfa and properly starting the more common forage crops.

Since alfalfa will produce a large crop of valuable feed, it should make satisfactory returns on the best land on the farm. However, with liberal fertilization, it will do well on coarse textured, "light" soils which are often considered poor and not satisfactory for shallow-rooted crops. Where the water table is within three feet of the surface, or on soils which are "heavy" and wet, either because of topography or compact subsoils, serious injury frequently occurs the first or second winter. Even on moderately wet soils, the addition of some alfalfa seed will usually make a better hay crop than clover and timothy alone.

Liming. Alfalfa is more sensitive to acidity than most other farm crops. Liming to reduce the acidity to between pH 6.3 and pH 6.7 is one of the inescapable requisites in the preparation. Most unlimed Connecticut soils are strongly acid (around pH 5.2) and require about three tons of limestone (or two tons of hydrated lime) per acre. With strongly acid soils it is safest to apply the lime the season before seeding, or in the spring before summer seeding. Moderately acid soils (pH 6.3-pH 5.8) require one to two tons of limestone and may be seeded soon after harrowing the limestone into the surface soil.

Fertilization. Since alfalfa produces large yields of hay and pasture high in feed nutrients it is not surprising that it takes large quantities of minerals from the soil. Fortunately alfalfa secures its own nitrogen from the air and only the minerals, calcium, phosphorus and potassium, must be supplied. Liberal additions of these before seeding aid in starting a crop, in reducing winter injury, and in maintaining good yields and stands over a long period. From 400 to 600 pounds of superphosphate, 20 per cent or equivalent, and 100 to 200 pounds of muriate of potash per

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acre are usually desirable. It is best to apply enough phosphorus before seeding to last several years, enough even for the life of the crop. Potash can be applied more effectively as a topdressing and, unless manure is used, a yearly application is often desirable, especially on coarse textured soils.

Varieties. Only the hardy or northern grown variegated varieties are suitable for Connecticut condition. Of these the Grimm has been used the most widely, chiefly because the producers have placed it on the market with certification seals which insure identification. Canadian Variegated, Hardigan, and other varieties which have been developed in the northern states are equally satisfactory but identification is sometimes difficult or even impossible.

Amount of Seed. Even a few pounds of seed scattered evenly on a compact, smooth seedbed, and covered lightly (one inch or less) will make a thick stand. Very thick stands mean small, weak plants. The following amounts (pounds per acre) will furnish ample seeds for thick stands when seeded carefully:

(1) 12-15 pounds alfalfa or (2) 12 pounds alfalfa, 2 pounds timothy for establishing alfalfa. (3) 4 pounds alfalfa, 6 pounds red clover, 4 pounds timothy for introducing alfalfa.

Mixture Number 2 has many advantages for conditions favorable for alfalfa. There is not enough timothy to cause serious competition but there is enough to make a turf which will reduce winter injury, reduce lodging of the first crop and fill in spots where alfalfa fails, yet not decrease the quality of the hay appreciably.

Mixture Number 3 contains ample clover and timothy to make a good crop without the alfalfa. Under conditions favorable for alfalfa it may make a satisfactory alfalfa-grass mixture after the second year.

Inoculation is necessary on land which has not grown alfalfa recently and costs so little that it should never be omitted. Secure a handful of soil from about each of a half dozen thriving plants in an established alfalfa field, dry in the shade (don't heat), sieve, and mix about a quart to a bushel of seed just before seeding. Slightly moistening the seed with a sugar syrup (equal parts sugar and water) before adding the soil will make more soil adhere to the seed.

EDITOR'S NOTE: *Slightly less troublesome is the use of one of the commercial inoculants on sale at most farm supply stores.*

Time of Seeding

It is essential that alfalfa make a vigorous growth of at least six

inches the first season. Other problems concerning the time of seeding are chiefly those of convenience and economy. The following are being used successfully:

Spring (April 1-May 15)	Crop Association
1.	In fall sown rye.
2.	With oats: ¾ bushel if cut for hay; 1½ bushels if pastured.
3.	Without companion crop.
Summer (July 1-August 15)	
1.	On harrowed oat stubble.
2.	Following tobacco or other early harvested tilled crop.
3.	Following early cut hay.

Seeding in rye is increasing in popularity. It demands complete liming before seeding the rye. The seed is scattered on the rye before the growth starts in the spring, then harrowed lightly to cover most of the seeds. Many seeds will cover without harrowing. However, a light harrowing is generally helpful. The rye can be pastured, or cut early for hay or bedding.

Seedings with oats should be made early and only where some lime has been used previously. A light seeding of oats and early cutting will give the alfalfa a better chance and not reduce the hay yields very much.

If the seeding is done early in the spring and conditions are favorable for alfalfa, there should be a growth large enough to pasture or to make hay in late July or August. Sometimes two crops can be secured. Such removal will not injure the stand, provided the alfalfa has made a good growth and is approaching maturity before the cutting. September cutting is usually disastrous. It is much better to cut or pasture in October, at the end of the growing season.

Putting Peat to Work

Condensed from New Jersey Agriculture

Firman E. Bear

Head, Soils Department, Rutgers University

THE peat deposits of a state or nation are one of its important natural resources. Such deposits consist of an accumulation of plant materials which have been partially decomposed to form humus. Every land owner knows that humus is a necessary part of a fertile soil. Special efforts are made to increase the humus content of soils by working animal manures, green manures,and crop residues into them. But it is good practice, in the more specialized lines of agriculture and horticulture, to make supplemental use of peat for this purpose.

New Jersey is especially fortunate in being richly endowed with extensive deposits of excellent peat. The total area of these deposits is estimated at 500,000 acres. Their depth ranges between 1 and 30 feet. The quantity of humus in them is sufficient to cover to a depth of one foot every one of the 750,000 acres of land now under cultivation in the state and leave plenty over to meet all of our other needs for many years to come. If this could be done, and if the peat were properly treated and mixed with the soil, it would have phenomenal effects on its productivity.

But such a procedure is not feasible for any large part of the cropped land. Most farmers must depend upon other means of increasing the humus content of their soil. A great deal of time and thought are devoted to this subject, and efforts are being made to devise new systems of soil management that will put more organic matter into the land. New, rapid-growing crops are being tried for plowing-under purposes. Marginal land is being used for the production of organic materials for hauling onto the crop land. In some cases, fields are being rested for a year or more, and cover crops, or weeds, are allowed to grow up and fall back on the soil.

The problem is such a large one, when applied to the entire cultivated acreage of a nation, that it has engaged the attention of some of the most capable scientists of this country. New Jersey is fortunate in having in its em-

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ploy one of the world's most famous humus experts, Dr. Selman A. Waksman, of the Agricultural Experiment Station. For the last 25 years, Dr. Waksman has spent a large portion of his time studying humus. His 500-page book entitled "Humus, Its Origin, Chemical Composition, and Importance in Nature," published in 1926, filled such an important place in the literature on this subject that the first edition was soon exhausted, and a second had to be published to meet the demand for it.

Dr. Waksman has just written a very interesting bulletin entitled, "Peat and Its Uses," which will be available, free, to residents of the state of New Jersey *after June 24.* This bulletin tells what peat is, how it is formed, how it is prepared for market, and how it is being used.

Large amounts of manufactured peat products are now being used by home owners around the yard and garden. They are also extensively employed on golf courses, for the production of composts, as stable litter, and for mulching purposes around horticultural plants. An excellent compost can be produced, says Dr. Waksman, by mixing two parts of peat with six of soil and one of complete fertilizer, and allowing the mixture to stand for a month or more.

One of the most important qualities of peat is its capacity to absorb water. This makes it especially useful as a litter around poultry houses, and as material to be mixed with soils which are being used for gardening purposes. New Jersey peats, on the oven-dry basis, will absorb from two to eight times their weight of water.

A word of caution is offered in connection with the purchase of peat products for agriculture use. New Jersey products ordinarily contain from 60 to 70 per cent water. This means that they contain from 30 to 40 pounds of dry matter for every 100 pounds of material. It is this dry matter, and not the moisture that is associated with it, which is of value in the soil. Part of this dry matter is ash, which is worth comparatively little. The value of a given weight of peat is in proportion to its content of actual organic matter. In the laboratory, the amount of organic matter in a given peat product is determined by weighing out a sample, in a dish, drying it in an oven, and weighing it again. The loss in weight is the water. The sample is then burned, after which the dish is again weighed. The material remaining in the dish is the ash. The loss in weight represents the amount of actual organic matter.

A miscellaneous variety of organic materials which are designated incorrectly as peat or com-

posts are being sold home owners, mostly by street peddlers. These include tea leaves, exhausted licorice roots, and a considerable number of other industrial waste products. These materials vary in value and usefulness. Some of them, because of their high alkalinity, or because of the presence of certain poisonous ingredients, may actually prove injurious to plants. Others may be equally as satisfactory as the standard peat products for soil improvement purposes. But it is necessary to be on guard against inferior products which are practically useless, or even harmful, in the soil. The only safe answer to this problem lies in buying soil improving products only from dealers of known reliability, or in submitting a sample of the material to the Experiment Station for examination and report.

Pigs

When weaned on pasture in experiments at the University of Illinois, pigs gained as rapidly and more cheaply on corn with a protein supplement of 2 parts tankage to 1 of soybean meal than other pigs getting complex mixtures containing several other protein feeds in addition to the tankage and soybean meal. Total feed required to make 100 pounds of gain was less with the simple ration.—*S. C., Ill., Successful Farming*

Corriedales for Crossbreeding

Condensed from The Southern Planter

Charles V. Wilson

Associate Professor Animal Husbandry, West Virginia University

DOMESTICATED sheep are natives neither of North America nor of the Western Hemisphere. The so-called "native" sheep making up our farm flocks of today in the eastern United States are descended from the mutton-type flocks of the British Isles and from the wool type flocks of Spain, the Spanish Merino.

Sheep were introduced into Virginia by the London Company in 1609, two years after the settlement of Jamestown. The number brought over from England can not now be determined, but historians state that because of slow increase, destruction by wolves, and other such causes, there were only 3,000 head of sheep in the Virginia colony in 1648, 39 years after their introduction.

In 1687, Virginia enacted a statute providing 300 pounds of tobacco for each wolf killed. Throughout this period Virginia attempted by enactment of legislation to build up her flocks and woolen manufacture only to have her governors or England nullify her attempts and compel the importation of woolens from the mother country.

By 1767, according to an English writer, the colonies were having more success in sheep raising and cloth manufacture. Cloth worth 12 shillings a yard was being produced, and some wool was exported to England. There were some excellent sheep on a few of the large plantations, but sheep in general were described as "indifferent, white, black, and piebald, yielding wool of varied quality and light in the fleece."

In the decades following 1800 the Spanish Merino was imported in enormous numbers, and for the next 50 to 60 years thereafter, wool growing and sheep raising were synonymous. The importation in large numbers of the British mutton breeds began after the close of the Civil War, and by 1890 the production of market or fat lambs had increased to the point that wool growing was a secondary source of income in eastern farm flocks. Over half of the approximately 17,000,000 sheep east of the Mis-

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sissippi River had been converted from wool to mutton type by the use of British breeds.

In 1926 the writer, representing the West Virginia Experiment Station, and D. A. Spencer, of the Sheep Office of the Bureau of Animal Industry, U. S. Department of Agriculture, revised a West Virginia Station project started in 1924. The revised project was planned to conduct co-operative breeding experiments with mutton-bred native ewes of the Appalachian region as the ewe flock. The experimental plans called for the use of a breeding ewe flock numbering 120 head and drawn from an established flock with its known history of breeding and management.

It was the good fortune of the co-operators to find a sheep owner with the required land, buildings, native ewe flock, and disposition to make same available. H. W. Beard, of Hillsboro, Pocahontas county, West Virginia, undertook the production and breeding work of the project under the direction of the co-operators. Mr. Beard and his father, the late M. L. Beard, furnished the ewe flock.

The native ewe flock from which the experimental flock was drawn came into the possession of M. L. Beard in 1885. This flock numbered some 700 to 800 head at the time the experimental work was begun in 1924.

A system of ear-notching in use by the flock owners permitted the recording of the breed of sire, grandsire, and for some of the ewes selected, the great grandsire. Fully three-fourths of the ewes were sired by Hampshire rams, the remainder by Shropshires. Three-fourths of the ewes had Shropshire grandsires; the grandsires of the remainder were either Oxfords or Dorsets.

The 120 head of ewes selected were sorted from approximately 200 head lambed in 1924 and reserved for the experimental work. They were divided into four uniform lots, and after producing a lamb crop in the spring of 1926, were mated under the co-operative experimental plans the last week in October of that year and each succeeding year, including 1929. As a result, lamb crops were produced each spring from 1927 to 1930, inclusive.

The objects of this experiment were (1) a comparison of Southdown, Shropshire, Hampshire and Cheviot rams for the production of market lambs when mated with native ewes of grade Hampshire type, (2) a study of the influence of breed on the quality and palatability of lamb meat which was a part of the national project, "Co-operative Meat Investigations."

Four purebred, registered yearling rams, a Southdown, a Shropshire, a Hampshire and a Cheviot,

were used each year. Each of the four lots of ewes was bred once during the four years to a ram of each breed. The matings were rotated to produce each year a lamb crop sired by a ram of each of the four breeds. At the end of the four-year period each lot of ewes had produced lambs sired by a different yearling ram each year —all within the four breeds.

Only a few of the items for which data were recorded are mentioned here. Effort was made to obtain and analyze a multitude of facts connected with the lambs, ewes, rams and their products. Weights of the ewes and rams were recorded periodically. At lambing time, data for the lambs were recorded for such items as sex, birth status (whether born singly or as one of twins), birth date, weight, sire and dam. The ewes were identified by serially numbered eartags, the lambs were identified likewise. At shearing time the fleece and mutton scores were recorded. The grease weight, length of staple, fineness, character, density and number of days the fleece had grown were all recorded.

The birth of all the lambs of each lot was approximately April each year. Over 90 per cent of the lambs were born in a three-weeks period beginning the latter part of March and ending early in April. All of the lambs were weaned the latter part of August each year and shipped to the U. S. Department of Agriculture, Research Center at Beltsville, Maryland, for slaughter and meat studies, made by co-operators in the Bureaus of Animal Industry, Agricultural Economics and Home Economics.

Just before leaving for Beltsville the lambs were weighed and appraised by a packer buyer and a commission salesman. The values were based on Jersey City lamb prices. On arrival at Beltsville the lambs were rested, conditioned and weighed again. Before slaughter they were graded and after slaughter the carcasses were graded carefully.

It should be clear that every attempt was made to get all the facts that might help determine or explain possible differences in the lambs because of breeding. The ewes were fed and pastured as one flock except for a six-weeks period at breeding time. The lambs were raised on their dams' milk and bluegrass—white clover pasture. No grain was fed to the lambs.

Fleece studies of the native grade Hampshire type ewes lambed in 1924 disclosed the following facts: (1) The wool fiber was dense, light shrinking, bright colored and strong. (2) The fineness of fiber was satisfactory for mutton type ewes, since it was quarter and three-eighths blood. These grades of medium wool

are in demand and sell readily. (3) The average fleece weight of little more than 4 pounds surely could be increased. (4) The staple length of many fleeces was less than 2½ inches. Such fleeces are classed as clothing wool with a lower value per pounds than combing wool that has greater staple length and higher value.

If fleece improvement with respect to length of staple and fleece weight could be made, and the valuable mutton qualities of the grade Hampshire type ewes and their market lambs maintained, such improvement would be very much worth while. With these goals in mind the investigators made new plans. The Corriedale was chosen as the breed of promise for bringing about the desired fleece improvement.

The ewe lambs reserved were sired by Hampshire rams, their grandsires were Hampshires, and their great grandsires Shropshires. The ewes were very closely related to the ewes of the first experimental flock, sixteen of which were selected on the basis of their records and added to the new flock. In late October, 1930, the new flock was divided into four uniform lots of approximately 30 head and each lot bred to a yearling Corriedale ram produced in the U. S. Government flock. Using the same rams the matings were repeated in October of 1931 and 1932. The three resulting lamb crops furnished the first-cross animals.

Data strictly comparable to those obtained in the first experiment were obtained for the Corriedale-sired wether lambs. The ewe lambs were all retained for breeding and fleece studies, whereas all of the wether lambs were sent to the U. S. Department of Agriculture, Research Center at Beltsville, Maryland, for slaughter and meat studies.

Now to consider some of the effects of breed of sire on market lambs, the comparisons are made for wether lambs, born and raised as single lambs. This choice is made, (1) because the Corriedale ewe lambs were not slaughtered, and (2) because lambs born and raised as twins that were sired by any of the breeds tested under the conditions of these experiments are not comparable with single lambs. These facts were true for birth weights, gains, dressed yields and carcass grades. The fact that two lambs shared the food supply furnished by the ewe, both before and after lambing, was responsible for the birth weight of each of the twins averaging 2 to 2.5 pounds less than for single lambs. This was true for all breeds tested. In addition, the single lamb gained from 10 to 15 pounds more than a twin lamb in the same period of time between birth and weaning, approximately 145 days. To the

thoughtful sheepman, what a revelation the statements just made must be! If the shepherd would only separate the singles and the twins and then feed the twin lambs grain by means of a creep!

The average birth weights of the Corriedale single ram lambs were 8.3 pounds, for the Southdown and Cheviot lambs 9.8 pounds, for the Shropshire 10.0 and for the Hampshire lambs 10.5 pounds. The average gains (birth weight excluded) on mother's milk and grass in 145 days were, Southdowns 67.3, Cheviots 70.2, Hampshires 71.7, Corriedales 74.2 and Shropshires 74.4 pounds. The average final or weaning weights were (birth weight plus gains), Southdown 77.1, Cheviot 80.0, Hampshire 82.2, Corriedale 83.5 and Shropshire 84.4 pounds.

The dressed yields in percentage based on weaning weight and chilled carcass weight were: Shropshire 44.1, Hampshire 44.2, Southdown 45.1, Corriedale 44.8, and Cheviot 45.3. The average carcass grades were high, good for all but the Hampshires. These averaged good.

The Corriedale Fleeces

Examination of these data substantiates the statement that the Corriedale-sired lambs gained, weighed at weaning and yielded dressed carcass that graded on a basis strictly comparable with lambs sired by the four other breeds. Corriedale rams bred to native grade Hampshire type ewes gave excellent *market* lambs that were very satisfactory. If now the desired *fleece* improvement could be secured, then the Corriedale could lay claim to a place in eastern mutton and wool production.

Comparisons are made for 111 grade Hampshire type dams and their 137 Corriedale-sired daughters. The dams were sheared in May, 1930, as yearlings, approximately 13 months old. Their average greasy fleece weight was four pounds with an average staple length of 3.1 inches. Forty-nine daughters were sheared in May, 1932. Their average fleece weight was 7.33 pounds, staple length 4.03 inches; fifty-seven daughters sheared May, 1933, averaged for fleece weight 8.50 pounds, for length 4.17 inches; thirty-two daughters sheared May, 1934, averaged 6.69 pounds of wool with a staple length of 3.95 inches. The averages for the 137 daughters were, for fleece weight 7.49 pounds, for staple length 4.07 inches. The average age of the daughters when sheared was 418 days, approximately 14 months.

Perhaps comparisons of the data for the fleeces sheared when the respective groups were two years old (the second fleece) will be helpful in arriving at a more

exact appraisal of the differences found. The ewes, both dams and daughters, were sheared in May of each year so that as two-year-old ewes their fleeces had grown for the same length of time, one year. In this comparison the averages for the dams' fleeces were, weight 5.23 pounds, staple length 2.53 inches; for the daughters, fleece weight 7.06 pounds, staple length 3.44 inches. Pointed and specific reference is made to the fact that all the Corriedale-sired daughters produced, that reached shearing age, were sheared and their fleeces are included in the averages. The investigators wanted to know the whole story, hence all the ewe lambs were tested. More sheepmen select the well-grown, most promising ewe lamb for flock replacement; that is, most real sheepmen do! With *all* the daughters included, confidence in the results obtained is enchanced, not lessened. Certainly then the Corriedale did increase the grease weight of fleece and did increase the length of staple! Given the data for weight of fleece and length of staple, it remains now to show the effect of the Corriedale on such fleece factors as yield of clean wool, fineness of fiber, and other such important items.

The fleeces produced were scoured at Norwood, Massachusetts, in a commercial wool-scouring plant for clean yield. It was found that shrinkage because of natural grease, dirt and moisture in the wool, was increased for the daughters but on a clean wool basis the daughters, as a rule, yielded 25 to 30 per cent more wool than their dams. The mill-sort data for grade showed a definite trend for an increase in the amount of three-eighth blood and, consequently, a decrease in quarter-blood wool for the daughters. More of the daughters' wool when compared with their dams' was a clear white wool when scoured, and nearly all of the daughters' wool was of combing length, 2½ inches or more. The density and character of fleece of the daughters were the equal of these factors for the dams.

Corriedale Cross Has Longevity

Mutton form and size were maintained in the cross-bred ewes; temperament, docility, mother instinct and vitality were wholly as good for the daughters as for their dams. It is highly probable that the life span of the daughters will exceed that of the dams. Many of the 49 daughters lambed in the spring of 1931 now released from the experiment, were bred, for purposes of observation, to a Southdown ram in October, 1939, and lambed in March and April, 1940, at ten years old! Many of them show relatively little signs of "break-

ing," that is, becoming infirm and unsound.

Breeding experiments with Corriedale rams have continued, from their inception in 1930, to the present. The grade Hampshire type dams were released from the experiment, their daughters replaced them. The daughters were bred to Corriedale rams, the resulting wether lambs were slaughtered and the ewe lambs retained. Many 4th generation lambs are at hand. The generations that have followed from mating the first-cross ewes and their ewe progeny back to Corriedale rams all confirm the results obtained in fleece improvement. The market lamb phase of the results is another story that can not be presented here. Since the first-cross ewes when mated to breeds of English-Scotch origin produce market lambs the equal of any produced by other matings tried, and since these first-cross ewes yield in addition the improved fleece reported, then perhaps the sheepman should be advised that for practical lamb and wool production, one cross of Corriedale on his native ewe stock will give him the fleece improvement he may desire. Resort to the use of Corriedale rams may be made from time to time, for example, after daughters sired by rams of English or Scotch origin and out of first-cross Corriedale ewes compose the flock.

The Poultryman's Daily Chores

Condensed from The Poultry Item

C. L. Henry

EVERY so often, the question arises as to just how much time it should take to clean, grade and pack eggs.

Before the subject can really be approached we must come to an understanding. For example, let us take a flock of 1200 to 1500 Leghorns. White eggs require a little more time than brown.

We will suppose that the flock is cared for by a good poultryman who takes pride in keeping the laying house floors reasonably clean and dry by the use of some good absorbent litter, the perches screened to keep the birds' feet cleaner and the nests well filled with shavings or with Stazdry, which we here at the Research Farm like best.

The eggs should be collected three times a day in clean wire baskets and stored in a cool damp cellar to cool before packing.

All these things relating to the care of the flock have quite a bearing on the time required to clean the eggs for if the eggs come in badly soiled it will require much longer for the cleaning work.

Let us suppose that the birds are in 60% production. This would mean for 1200 to 1500 birds, from seven to nine hundred eggs a day to grade, clean and pack in cases.

Now, what kind of cleaning equipment should we use? At the Research Farm some years ago we started using a piece of steel wool, but if you value your fingers, don't use it. Later we used the Perfection Egg Cleaner which consisted of a buffer made of nine pieces of Carborundum cloth, belt driven by a small motor. Next, we used the same buffer only it was slipped on the shaft of a ¼ H. P. motor. This worked quite fast but it was a bit cold on the hands. It proved to be a very practical, inexpensive cleaner which we used to clean up to 1800 eggs daily. About two years ago we purchased a Magic Egg Cleaner and as a timesaver it beats anything we have tried.

This cleaner, set on a shelf just above the egg cases with an egg scale in front, makes a set-up that would be hard to beat for speed and convenience.

The eggs are just dropped into the cleaner and this size will clean up to twelve eggs at once.

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The operator can take three or four eggs in each hand every time he reaches in the egg pail, putting the dirty one in the cleaner and the clean ones over the scale very quickly. When the egg is clean, just a touch of the finger is required and the egg comes out of the cleaner. If the eggs are not too dirty, the twelve-egg machine is almost never full as they should be removed as fast as they are cleaned. Your hands are moving all the time. There is no waiting. With the motor and buffer cleaner you have to stand still, holding one egg at a time and rolling it in your fingers to clean any spots off. The Magic Cleaner is rather expensive on first cost, but it is used daily and for a flock of this size it will give a poultryman many extra hours, in the course of a year, for other jobs that should be done.

The small Zenith scale that we use has a maximum and minimum stop or bumper. The minimum bumper is set just above twenty ounces, so when a small egg is placed on it lightly and the scale does not start, you know it is a pullet size, and if the scale starts it is a medium. The maximum bumper is set at 24 ounces so when a large egg is placed on it and it rests on the bumper it will grade large. If it lifts off, it is a medium. With this scale there is no waiting for the egg to teeter to a stop. You know at once in just what grade each egg falls.

Using the Magic Egg Cleaner and Zenith Scale it takes just about fifty minutes to get 800 eggs out of the pails, through the cleaner, over the grader and into their respective crates. Using the motor with the buffer it requires about two hours for the same number of eggs.

There are many other good cleaners and graders on the market but it has been the writer's experience that this is a very fast and convenient way of handling the eggs. Most of the mechanical cleaners require two men to operate efficiently.

We do this whole job in one operation but on some farms perhaps some one would clean eggs while others graded and packed. If it were worked this way, 800 eggs could be cleaned in about forty minutes with the Magic Cleaner. It would then take about 36 minutes to grade and put them in their proper cases, using the hand grader.

With the motor-driven buffer cleaner it would require approximately 1½ hours just to clean the dirty eggs each day from a flock of 1200 to 1500 birds.

A new portable cleaner consists of a small motor, operating a round rubber blanket coated with carborundum. This is made by the Keen Equipment Co. It seems to be very practical for single eggs.

Cleaning Dirty Eggs

Under average farm conditions about one-fourth of all eggs laid are dirty or slightly dirty. The wholesale price of dirty eggs in some markets is from 4 to 7 cents lower than for clean eggs. Tests at the Missouri Agricultural Experiment Station indicated that dirty eggs, easily cleaned with 1 per cent lye solution, kept equally as well as unwashed clean eggs and sold for as high a price when marketed. Experienced egg handlers were unable to distinguish between lye-cleaned eggs and unwashed clean eggs. Edible qualities were equally as good.

Dissolve 1 ten cent can of high test lye in 10 gallons of water; or dissolve 2 LEVEL teaspoons of lye in each quart of water. Prepare a fresh solution each time you wash eggs. Use rubber gloves.

Soybeans

The New York Experiment Station reports a new bean variety to be called Seneca, which is expected to prove a boon to dairy farmers. Seed will not be available until 1941. The new variety will be used chiefly for grain; it produces about 30 percent more than the present popular variety, Cayuga. It has been producing more than 35 bushels to the acre on the University Farm at Ithaca for several years.—*Successful Farming*

Beekeeping

Everett Franklin Phillips

BEEKEEPING is a peculiar occupation in that it can be followed in town or country, by young or old, by rich or poor. Many women are numbered among the ranks of beekeepers. To the professional or business man, it offers a change from the confinement of office or laboratory. To the mechanic, it serves equally as well for recreation. Lawyers, artists, farmers, ministers, merchants, brokers, professors in universities and laborers are numbered among its devotees.

With such an array, it may seem fruitless to ask who should be beekeepers. The care of bees is not, however, equally well suited to all persons, and it would save much disappointment, both financial and otherwise, if this question were more frequently asked before embarking on this business. First of all should be excluded those persons who are seriously affected by the poison of bee-stings. To some this is a serious matter and, unless it is imperative that they care for bees, it is better for them not to undertake it. To practically all beginners the stings are annoying, and the experienced beekeeper, however much he may brag of his indifference to stings, still suffers as much pain from the prick as he did at first. With time and numerous stings, an immunity to the poison is developed which eliminates the after-swelling, which is the most annoying feature of the stinging.

To keep bees with interest and profit requires an intimate study of the insects and a detailed knowledge of their needs. It further requires a knowledge of the plants from which they gather nectar so that the necessary steps may be taken to get the colonies in proper condition for the work required of them. To be a good beekeeper, one must read and reread the books and journals pertaining to the subject, for each reading, accompanied by additional experience among the bees, brings out some new point which proves important in the practical work. Furthermore, the beekeeper cannot work by rule of thumb. Bees are living, lively animals and may be "expected to do the unexpected," as beekeepers so often express it. For this reason, it is necessary for the beekeeper to know the behavior of bees in all phases and in so far as they have been determined, which is not far, the causes of their vari-

Reprinted by permission from the book "Beekeeping" published by the Macmillan Co.

ous activities, Patience, power of concentration and sympathetic understanding of the bees are essentials and, as a result, the bees become pets rather than beasts of burden. Persons who fail to appreciate bees from this point of view will probably find it more pleasant and profitable to let them alone. Like all general statements about bees, there are exceptions to this one.

A question much discussed is that of beekeeping for women. Many women can and do handle bees with marked success. In those parts of the business which require delicacy of touch and minute attention, such as queen-rearing, women often surpass men in proficiency. As amateur beekeepers they are at home. The question which usually presents itself, however, is whether beekeeping is suitable for women as a means of livelihood. Professional beekeeping on a scale sufficiently large to supply an adequate income requires long hours of work in the hot sun, heavy lifting and unremitting physical endurance. On a small scale these obstacles may be overcome, but in a commercial apiary the work must be done promptly, for delay means loss. While some women have found pleasure and profit in commercial beekeeping, it emphatically cannot be recommended for the majority, and this should be made clear to avoid disappointment for those who may be attracted to it. Of course, this applies only to those women who have no man in the company to do the heavy work. Many a professional beekeeper has received assistance of incalculable value from the women of the family. It should be made clear that the obstacles to the commercial success of women beekeepers are physical ones only.

Where Bees May Be Kept

It has been the pleasure of the writer to visit apiaries on the roofs of city buildings and in the almost desert valleys of California, in city backyards and in the mountain wilds, in small towns, on farms, in Canada and in the tropics. In diversity of location these apiaries are as varied as their owners. While recruits to the ranks of beekeepers may be found in all ages and conditions of men, so bees may be kept in places which would at first appear utterly unproductive, as well as in places which are obviously abundant in their nectar supply. The uninformed observer may fail utterly in his estimate of the value of a location from the standpoint of the bee. Most of the valuable nectar-secreting plants do not have large highly colored flowers, and the cultivated varieties of the flower-graden are of insignificant value. Bees fly for two or three miles for forage and may go even farther in emer-

gency. In choosing a location, it is therefore necessary that in the range of flight there be an adequate supply of nectar-producing plants. The ideal location is obviously one in which the nectar supply is near so that it may be obtained without the loss of energy incident to long flights.

The stories sometimes told of honey crops obtained from single colonies or of rapidity of increase in number of colonies are likely to mislead the beginner and to cause him to believe that beekeeping offers opportunity to get rich rapidly. While it is true that several hundred pounds of honey have at times been obtained from a single colony in a season, this is by no means usual. In apiaries managed for comb-honey-production, it is perhaps fair to estimate the average annual crop at 25 to 30 sections. For extracted honey, larger averages are expected, perhaps from 40 to 60 pounds. In the hands of a good beekeeper there is less difference in the amount of honey of the two kinds harvested, and the good beekeeper also far exceeds these average yields, because of his better management. The financial returns depend on market conditions and on the methods of selling the crop. If sold by the beekeeper direct to the consumer, a pound of extracted honey brings 20 cents up, while a section of comb-honey at present sells to the consumer at 25 cents up. It will be understood that prices vary from year to year, depending on the available supply and on the demands of the market, both factors to a considerable degree outside the control of the individual beekeeper. If the crop is sold to wholesale dealers, the return is considerably less but there is usually less liability of financial loss and less time is consumed in selling. Naturally these estimates must be dependent on the quality of the product and on the neatness of the package. In addition to labor there are certain expenses for supplies, such as comb-foundation, sections, hives and other fixtures, not counting the apparatus used in increasing the apiary. These may cost from 60 cents to $1.00 for each colony a season.

Estimates such as these are really of little value since the returns differ so greatly according to the kind of honey obtained and the facilities for marketing. For example, the white-clover honey of the North brings a higher wholesale price than do the amber honeys from most regions farther south, but on the other hand the southern beekeeper usually enjoys a longer nectar-secreting season and often obtains larger yields from each colony. Estimates are also greatly modified by the energy displayed by the beekeeper in the development

of local markets, some beekeepers selling out their entire crops at good prices and finding it necessary to buy more honey than they produce to care for the demands of the trade which they develop.

Another factor which must not be overlooked is the beekeeper. Anyone may reap a heavy harvest in the season when the nectar is abundant, but in the lean years, which come more often than desired, only the good beekeeper makes the most of the nectar at hand. And then come years of practically total dearth of nectar, when feeding is necessary to keep the colonies alive.

Taking all those factors into consideration, it may be justly concluded that a successful beekeeper is usually well repaid for the time he spends in his work, if he considers the return in the sense of wage. He may also consider that he has received the interest on his original relatively small investment. He usually averages little more than this, however, so that beekeeping is in no sense a "get-rich-quick" business. Its advantage as a recreation over most other occupations of a similiar character is that it is a means of occupying time not otherwise engaged to a financial profit and the returns, therefore, often add that part to the income which brings comforts and pleasures.

Beekeeping yields a quick return on the investment, for frequently in a good year a colony will pay for itself. In fact, there are few branches of agriculture which on so small an investment will yield as great a return. It may at least be said for the person who decided to try out beekeeping that he does not stand to lose much.

The above is an excerpt from Beekeeping by Everett F. Phillips, which we recommend as an excellent book on Beekeeping. It is published by The Macmillan Company, and for the convenience of our readers it may be purchased through the Farmers Digest ($4.00).

Beef Men Must Be "Carcass Conscious"

Condensed from The American Hereford Journal

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IF a modern Rip Van Winkle were to awaken from one of his long sleeps, he would experience many surprises; if he had known something about cattle prior to his extensive nap, he would undoubtedly be amazed at modern trends in beef. The market cattle of 40 or 50 years ago were heavy, highly fitted and often wasty to an extreme. It is recorded, for example, that in one of the steer classes at the Chicago Fat Stock Show in 1878, there were 12 entries; Weights ranged from 1,980 to 3,155 pounds; the average was 2,491 pounds and the champion of the show weighed 2,185 pounds. And then one thinks of that great Canadian steer, Clarence of Kirklevington, which campaigned in the early 80's and was grand champion at Chicago at a weight of 2,400 pounds.

We are reminded quite frequently that consumers' demands have changed and are changing. That the progressive breeder of meat animals must accommodate himself to the changing requirements of the trade is apparent and it becomes one of the duties of modern fairs and exhibitions to offer leadership to producers. In this, many of our competitive exhibitions have been eminently successful; some have not been so successful.

With special reference to beef cattle that are shown in market classes, those who fit the animals and those entrusted with the responsibility of judging should ask themselves how closely the winners approach utility standards. It will be argued, of course, that the showring standard for fat cattle should be set beyond that which the average commercial cattle will attain because the percentage of unfinished cattle coming to market annually is all too high. But there have been many instances, too many, where the champion steer, although a model of symmetry and thickness, yielded a carcass so much overdone that it was definitely undesirable from the retailer's and consumer's point of view and it would seem appropriate to attempt to bring the showring cattle more closely in line with dressed beef standards.

At the same time, there have

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been occasions when a low-set, blocky but underfinished bullock has been sent to the top in a market class, in other words, placed first because of conformation alone when steers of poorer conformation but with a better degree of covering, farther down the line would have hung more acceptable carcasses.

Carcass competitions have indicated, among other things, that many mistakes have been made in placing show steers. Is it not possible that breeders, feeders and judges might become somewhat more "carcass-conscious" in regard to show steers? What, then, constitutes an ideal carcass and what are the live animal manifestations of carcass quality? The consumer buys a joint of beef primarily for the sake of the lean meat that it contains, although the intelligent buyer recognizes that fat in optimum amounts and correctly distributed, makes the lean meat much more choice. Hence the demand for market cattle possessing natural thickness of muscle and at the same time, adequately and correctly covered with fat.

Let there be no mistake about it, conformation is a matter of extreme importance; and breeder, feeder and showring judge are amply justified by all reliable standards in selecting symmetrical cattle with short necks, short legs, well-sprung ribs, wide and deep loins, well-filled and level rumps and thick thighs. But no beef animal is prime for slaughter and capable of yielding a superior carcass unless fattened to the proper degree.

Strange as it may seem, few people have appetites for pure beef fat, yet all consumers pronounce the lean from fat carcasses to be the choicest. Why? Because with the accumulation of fat on the outside of the carcass, there is a perceptible deposition of fat between the muscle fibres. That inter-muscular deposition is known as marbling and is one of the best evidences of quality in beef; it contributes in a large way to flavor and juiciness in beef.

What significance then should one attach to such observations, in setting up standards for beef steers? Just this, that there seems to be a distinct relationship between marbling and two factors which are discernible in the live animal—degree of fat and smoothness with which it is deposited. The exhibitor in selecting his show steers and the judge in placing his classes should look for sufficient finish to ensure supreme quality in the meat but not overfinish which would make for waste in the carcass and higher cost of lean meat to the consumer.

A bullock is finished when there is a fair degree of covering on the lower rib and probably

that is the best single place to judge the kind of finish that is being carried. The middle or lower rib is about the last area to cover. Inasmuch as there is a distinctly greater tendency to marbling in those cattle which have smoothness of external fleshing coupled with optimum amount of fat, the modern tendency should be toward increasing discrimination against roughly fleshed or patchy cattle.

There was a time in years past when cattle buyers would judge the fitness or primeness of steers by the deposit of fat at the pin bones or the fullness of the cod. Such a criterion is not adequate today, especially in show steers, because uniformity or evenness of fat covering is believed to be more in keeping with actual quality and utility of the beef than excessive deposits in some areas, which must spell excessive waste.

The modern ideal in show steers, then, should be an animal that is, first of all, correct for beef conformation, reflecting good beef breeding; second, sufficiently fat to satisfy the most discriminating trade, but not overdone; third, carrying fat of proper distribution with a complete absence of lumps; fourth, covered with fat of good quality, being firm but not hard; and fifth, a good yielder, trim and not excessively filled. After all, a good beef carcass is the ultimate goal of the cattlemen and the fact cannot be overlooked in the showring.

Economic Advantages and Limitations of Soil Conservation on Illinois Farms

Condensed From Soil Conservation

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SIGNIFICANT results are being obtained from a co-operative study in Illinois to examine the economic effects of a soil conservation program, and to ascertain and analyze factors of good farming under soil-conserving conditions. Detailed farm records are being kept on farms co-operating with the Soil Conservation Service in its demonstration program and also on neighboring farms that are following the usual systems of farming.

During the 4 years, 1935 to 1938, comparative economic studies have been carried on in the three Soil Conservation Service project areas in Illinois (Le Roy, Edwardsville, and Freeport) and in two Soil Conservation Service camp work areas (Marion and Aledo). In the Le Roy area, where farm records have been kept since 1935, farms co-operating with the Service program were matched, in so far as possible, with neighboring non-cooperating farms on the basis of number of acres, soil ratings, proportions of land tillable, and land valuations.

While normally 3 to 5 or more years are required to establish completely a soil-conserving system of farming, account records covering in all cases 1 to 4 years after the program was initiated already show striking results in an economic comparison of co-operators and non-cooperators. By 1938, cooperating farms in the Le Roy area had improved materially over those employing the usual system of cultivation (see table 1).

Thirty-nine cooperating farms, following a planned program of soil-erosion control, were developing during this time a much sounder land-use system from the standpoint of a permanent agriculture than that of 33 neighboring farms not following a planned program of soil-erosion control. These cooperating farms grew less corn, oats, wheat, and soybeans, acre for acre, than their neighbors, and still had higher incomes. In 1938, the conservation farmers had in soil-building legumes almost twice as much tillable land as non-co-

Reprinted from Soil Conservation, Washington, D. C.

Table 1—Trends in land use, cooperating and non-cooperating farms

Year	Proportion of tillable land in grain crops		Proportion of tillable land in hay and pasture		Proportion of tillable land in soil-building legumes	
	Cooperators	Non-cooperators	Cooperators	Non-cooperators	Cooperators	Non-cooperators
1935	77.8	86.5	22.2	13.5	8.8	2.7
1936	78.6	88.2	26.4	11.8	15.9	4.8
1937	71.7	91.4	28.3	8.6	13.8	3.1
1938	77.0	83.5	23.0	16.5	16.2	8.9

operators. Upward trends in hay and pasture and in soil-building legumes for non-cooperators in 1938 were due to increased participation in the A. A. A. program and the adoption of some of the practices observed on farms of Soil Conservation co-operators.

Improved rotations (including the use of green-manure crops), applications of limestone, phosphate, and fertilizer as well as a larger amount of animal manure, and soil-conserving practices such as contour farming, strip cropping, terracing, and use of buffer strips and grass waterways, were reflected in substantial improvement in crop yields on co-operating farms as compared with non-cooperating farms (table 2).

These crop yields on conservation farms represent the improvement attained while the planned program is still in its early stages. It is expected that in the future the long-time results of following a good system of land use will be even more significant than results secured in the first 4 years of this study.

By 1938, livestock was playing a relatively more important part than in 1935 in the higher earnings obtained on cooperating farms. As compared with non-cooperators, these farms had larger investments in livestock, fed more feed and were more efficient in feeding operations. In 1938, cooperating farms fed feed valued at $1,169 (exclusive of pasture) to productive

Table 2—Trends in crop yields on cooperating and non-cooperating farms

Year	Corn, bushels per acre		Oats, bushels per acre		Soybeans, bushels per acre	
	Cooperators	Non-cooperators	Cooperators	Non-cooperators	Cooperators	Non-cooperators
1935	49.8	47.2	32.5	29.8	16.3	19.4
1936	29.5	27.7	25.2	25.7	18.4	18.5
1937	55.6	48.8	51.5	48.3	22.2	19.6
1938	54.6	48.4	35.5	31.5	28.2	21.9

livestock as compared with $692 for farms following the old system. In 1935, cooperators fed feed valued at $1,007, and noncooperators $772. With more roughage produced at a result of the conservation program, operators of conservation farms naturally increased the number of roughage-consuming livestock in order to utilize forage crops most profitably. Good soil-building legumes used in hay and pasture mixtures on cooperating farms resulted in higher quality roughages and hence in more effective livestock gains from the point of view of efficient farming.

The data in table 3 indicate a close relationship between legumes, livestock, and crop yields. Sufficient legumes in the cropping system, combined with enough livestock to make economic use of the legumes, proved profitable on farms included in a long-time farm account study in Illinois. The data show that at the start of the 10-year period, the farms with the most legumes and livestock had an average advantage of 2.9 bushels of corn per acre, and at the end of the period they had an average advantage of 9.4 bushels per acre.

Average cost for man labor, horse labor, and machinery per crop-acre, were somewhat higher on cooperating farms during 2 of the first 3 years of the study. By 1938, however, there was no significant difference in these items on the two groups of farms. Total operating expenses per acre in that year were $10.83 on cooperating farms and $10.84 on non-cooperating farms. These operating expenses include the annual charge for limestone and phosphate applied in 1938 and in previous years, as well as all other operating expenses such as those for machinery, equipment, labor, seeds, fencing, building repairs, taxes, and miscellaneous items.

Based on the records, it appears that after initial improvement is made, soil conservation practices such as strip cropping, contour farming, farming with terraces, the establishment and

Table 3—Percent of tillable land in soil-building legumes, amount of livestock fed, and corn yields on 57 central Illinois farms, 1925-34

Item	20 farms with most legumes and livestock	20 farms with least legumes and livestock
Percent of tillable land in soil-building legumes ...	21.4	11.1
Feed fed per acre to livestock	$13.55	$6.88
Corn yields per acre:		
Average, 1925, 1926, and 1927	51.9	49.0
Average, 1932, 1933, and 1934	49.9	40.5
Average, 1925-34	49.5	45.0

maintenance of grassed waterways, and the adoption and following of a good system of land use have not increased total farm operating expenses. Costs of materials furnished by the Soil Conservation Service, such as limestone, fertilizer, seeds, and fencing and charges for the use of terracing machinery, C. C. C. labor, and Service technicians' time, have not been included in the farm operating expenses on the Soil Conservation Service cooperators' farms as shown in table 4. These costs, if spread over a period of 3 to 5 years, would be relatively low compared to the regular operating expenses of the farm. The data secured in this study as well as data from long-time farm record studies in Illinois indicate that if higher costs occur in the years when the program is being inaugurated, these costs are likely to be more than offset by increased returns in later years as the soil improvement program becomes effective and as losses from soil erosion are brought under control.

The real test of the feasibility of conservation is a determination of net returns in dollars and cents, and here again the cooperating farms have shown better results. They had larger gross incomes and their expenses were no higher; hence their net incomes were larger than those of noncooperating farms as may be seen in table 4.

Based on the average-size farm in this study (193 acres), cooperating farms in 1935, the first year the program was underway, had an advantage in net income of $288 per farm; in 1936, $355 per farm; in 1937, $648 per farm; and in 1938, $490 per farm. While these data show that cooperating conservation farms had somewhat higher net returns when the conservation program was inaugurated, they also show that the spread in earning power between conservation and nonconservation farms increased during the 4-year period. The well-planned conservation program, embodying the best use for each acre of the farm, paid divi-

Table 4—Gross income, total expenses, and net income on cooperating and non-cooperating farms

Year	Gross income per acre		Total expenses per acre		Net income per acre	
	Cooperators	Non-cooperators	Cooperators*	Non-cooperators	Cooperators	Non-cooperators
1935	$14.86	$13.91	$ 8.57	$ 9.11	$ 6.29	$ 4.80
1936	21.55	19.67	9.77	9.73	11.78	9.94
1937	20.44	16.81	10.54	10.27	9.90	6.54
1938	18.40	15.87	10.83	10.84	7.57	5.03

*Contributions of Soil Conservation Service not included.

dends for the conservation farms.

The smaller sample of data available on other Soil Conservation Service demonstration areas under study shows results similar to those obtained in the Le Roy area. In fact, the farm record studies made to date indicate that a planned program of soil conservation and erosion control not only makes possible higher farm incomes, but also provides for maintenance and improvement of soil resources and for farm improvements, thus adding to the capital assets of farms.

The higher incomes possible under the individual farm programs are, of course, predicated upon prices for farm products being maintained at fair levels.

The available economic data provide a strong argument in favor of conservation farming under Illinois conditions; in fact, they indicate that a farmer cannot afford to disregard such a program. Paradoxically, those farmers who have been in most urgent need of soil-conserving measures for the most part could not afford to adopt such a program. The chief reason for this is that current income has not been large enough to enable them to meet current operating and living expenses (including the payment of interest and indebtedness) and at the same time provide for the initiation of a soil conservation program which of necessity requires long-term planning. An outlay of cash, a source of credit, or government aid is usually necessary to enable farmers to take the initial step in a planned program of soil conservation and erosion control. On the majority of those farms that need to adopt a conservation program, the principal help available to farmers is that provided by the A. A. A. program, with payments for specific soil-building practices. Government aid through the Soil Conservation Service is tapering off as demonstrational phases of the program are drawn to a close, and at best this aid is limited to the project and demonstration work areas and soil-conservation districts.

In all the Soil Conservation Service demonstration areas in Illinois where farm records were secured, the low-income farms (in most instances farms that were badly eroded and in a low state of productivity) did not have large enough incomes to permit that much if anything be spent in the inauguration and adoption of a conservation system of farming. This is illustrated by the "cash farm balance" (cash available for farm family living expenses, interest payments, debt retirement, etc.) on the low-earning one-third of the farm account keepers' farms for 1937, the most representative

of the 4 years, 1935-38. This balance averaged per farm for the several areas as follows:

Le Roy area, $868; Edwardsville area, $764; Freeport area, $1,037; Aledo area, $272; and Marion area, $43. In connection with these data, it should be realized that farm account keepers represent better-than-average farmers in their communities. Considering the heavy indebtedness on many of these farms, together with the fact that a large proportion are tenant operated and that this cash balance must be divided between tenant and owner, it can readily be seen that limited available cash is a serious deterrent to the individual farmer's inauguration of a program of soil conservation and erosion control.

The farm record studies have demonstrated the economic advantages of a planned program of soil conservation. They have also pointed out the fact that in many instances such a program is not economically possible since full benefits may not be realized for a number of years.

Ants Gather Grass Seed

Condensed from Farm and Ranch

W. J. Newman

Soil Conservation Service

BUFFALO grass (Buchloe dactyloides) seed can be harvested very easily and with little cost around red ant hills, according to Elm Creek Soil Conservation Service technicians who directed Frank Mayborn, a Bell county, Texas, farmer, gathering 201 pounds of seed from a native Buffalo grass pasture in the western part of Bell county. The Elm Creek technicians observed that red ants gather the seed from the Buffalo grass pastures and pile them around the ant hill. Where ant hills are numerous in a Buffalo grass pasture, Buffalo seed usually can be found in considerable quantities. This was explained to Mr. Mayborn, and he secured permission from Ed Flint, owner of a good native Buffalo grass pasture in the western part of Bell county, for gathering Buffalo grass seed from the pasture. Last fall the seed was swept into piles with a stiff push broom, commonly called a street sweeping broom, and then shovelled into ordinary burlap sacks. In two days 788 pounds of seed and foreign material (mostly rock, dirt, and grass material) were harvested by one laborer. This seed material was run through a commercial cleaner, in order to separate the foreign material and noxious weed seeds, such as needle grass; this process cleaned out 201 pounds of seed.

It is unnecessary to use a seed cleaner, since "wind cleaning" would be sufficient for planting. Where seed is found in sufficient quantities scattered over an area in a pasture, the sweeping method with a push broom has been found also to be an economical and easy way to harvest Buffalo grass seed. This method can be used when seed cannot be found around ant hills. This is, however, a much slower method, as only an average of approximately 100 pounds of seed material can be harvested in a day. The pasture grass has to be very short when the seed is swept up from a pasture. Two sacks of the seed were harvested in the pasture where the seed had been piled up in drifts caused by rain washes, and a sample of this seed was taken for a comparison with that gathered around the ant hills to determine whether the seed

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around the ant hills has as high germination test as that harvested away from the ant hills. Samples of the seed were sent to the Texas Agricultural Experiment Station at Temple, Texas, for a purity and germination test. The results obtained from these tests are given as follows:

From the germination test it can be seen that the seed gathered around the ant hills have about the same germination as the other seed, but the purity test shows that the seed around ant hills have a greater per cent of residue, which is due to rock pebbles.

From the purity and germination tests of these samples, it is recommended that 6 pounds of the seed gathered from the surface of the pasture should be used to seed 1 acre, and 8 pounds of seed gathered around the ant hills should be used to seed 1 acre when drilled in 3-foot rows. If the seed is to be broadcast by hand, it is recommended that 10 pounds of the seed gathered from the surface of the pasture and 13 pounds of seed from the ant hills be seeded on each acre to be established to pasture. When the winding method is used to clean the seed, it is suggested that the above rate of seeding be doubled.

PURITY TEST

Sample Number	Per cent of Seed	Per cent of Residue
1 (Cleaned seed, gathered from pasture surface)	53.3	46.7
2 (Cleaned seed, gathered around ant hills)	26.6	73.4

GERMINATION TEST

Sample	Per cent Germination Average
1 (Cleaned seed, gathered from pasture surface)	43.4
2 (Cleaned seed, gathered around ant hills)	40.0

Equipment for Chemical Weed Control

Condensed from Pacific Rural Press

O. C. French

University Farm, Davis, California

EQUIPMENT for applying liquid materials for weed control varies greatly as to general appearance, yet fundamentally all is similar. Sprayers consist of a pump and tank, a boom with flat fan spray nozzles, and all mounted on some type of carriage for transporting. For non-corrosive materials, such as diesel oil and sinox, any pump such as rotary, displacement or compressed air type capable of maintaining 100 pounds pressure at the desired capacity is satisfactory. Sulfuric acid requires either an acid-resistant pump and tank or use of the ejector type of sprayer. The use of acid also necessitates acid-resistant nozzles and boom.

Selective spraying on grain for control of broad-leafed annual weeds demands application during the season when the ground may be soft, hence provision must be made to transport heavy equipment without getting stuck and also to prevent cutting up the field any more than necessary. Many farmers have mounted their field sprayers on tracks which have proved very satisfactory. Tank capacities vary; for large sprayers from 500 to 1000 gallon tanks are being used. The width of spray booms likewise vary, from 20 to 30 feet has been common although on one or two very large rigs 50 feet of boom has been used.

The construction and arrangement of booms are still a matter of opinion; some operators prefer all of the boom mounted off one side of the sprayer, others on both sides and at the rear of the sprayer, and still others on both sides and with a short middle section ahead of the tractor. Regardless of where the boom is mounted it seems desirable to make it out of 1¼ inch pipe drilled and tapped for ¼ inch male fitting nozzles. The boom must be adequately trussed to make it rigid. It should also be adjustable for height to adequately cover various heights of vegetation, and easily folded to permit passing through gates.

Experimental tests with sinox indicate that it can be applied in a fairly concentrated mixture, thus saving much transportation of water. This fact may also al-

low all of the spray equipment to be mounted on a tractor, thus simplifying the unit and reducing the cutting up of the field to a minimum. The airplane has also been used to satisfactorily spray sinox on grain and flax fields. We may see an important development of this type of spraying in the future.

For distributing dry materials such as arsenic trioxide, sodium chlorate or boron materials, some form of wheelbarrow type hand operated equipment is desirable. Equipment that is available commercially is limited to free flowing material such as sodium chlorate. For arsenic trioxide, which is a very heavy material and packs badly, none of the commercial units are satisfactory.

A few years ago the Division of Agricultural Engineering devised a wheelbarrow distributor that was capable of uniformly metering and distributing arsenic as well as mixtures of arsenic and chlorate or boron materials. Plans for this machine are available from the Division of Agricultural Engineering. Another machine, a modification of the one just mentioned, was constructed by the U. S. Forest Service to sterilize fire breaks in southern California.

For the Farmer's Library

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Son, Inc. $4.00.
(See Farmers Digest, November, 1939)

Beekeeping—By Everett Franklin Phillips, Professor of Apiculture, Cornell University. Published by the Macmillan Co. $4.00.
(See Farmers Digest, July, 1940)

Breeding Your Own, or Raising Colts for Pleasure and Profit — By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. Macmillan Company. $3.60.
(See Farmers Digest, February, 1940)

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, head of the Animal Dept., Cornell Univ. Morrison Press. $5.00.
(See Farmers Digest, October, 1939)

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. Macmillan Co. $2.90.
(See Farmers Digest, January, 1940)

Livestock and Poultry Diseases—By W. A. Billings, Asst. Prof. of Vet. Medicine, Univ. of Minnesota. Macmillan Co. $3.50.
(See Farmers Digest, June, 1940)

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw, Hill & Co. $4.00.
(See Farmers Digest, July, 1939)

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. Macmillan Co. $3.75.
(See Farmers Digest, September, 1939)

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. Pub. McGraw Hill Book Co. $5.00.
(See Farmers Digest, May, 1940)

For the convenience of our readers, books listed may be purchased through this Department. Address C. Leavitt Dyer, Farmers Digest, Ambler, Pa.

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